Fire Control Notes
VOL. 7 JULY 1946 No. 2

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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 7 Number 2

FIRE CONTROL NOTES

A Quarterly Periodical Devoted to the TECHNIQUE OF FOREST FIRE CONTROL

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

FIRE CONTROL NOTES is issued by the Forest Service of the United States Department of Agriculture, Washington, D. C. The matter contained herein is published by the direction of the Secretary of Agriculture as administrative information required for the proper transaction of the public business. The periodical is printed with the approval of the Bureau of the Budget as required by Rule 42 of the Joint Committee on Printing.

Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., 15 cents a copy, or by subscription at the rate of 50 cents per year. Postage stamps will not be accepted in payment.

Address DIVISION OF FIRE CONTROL
Forest Service, Washington, D. C.

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1946

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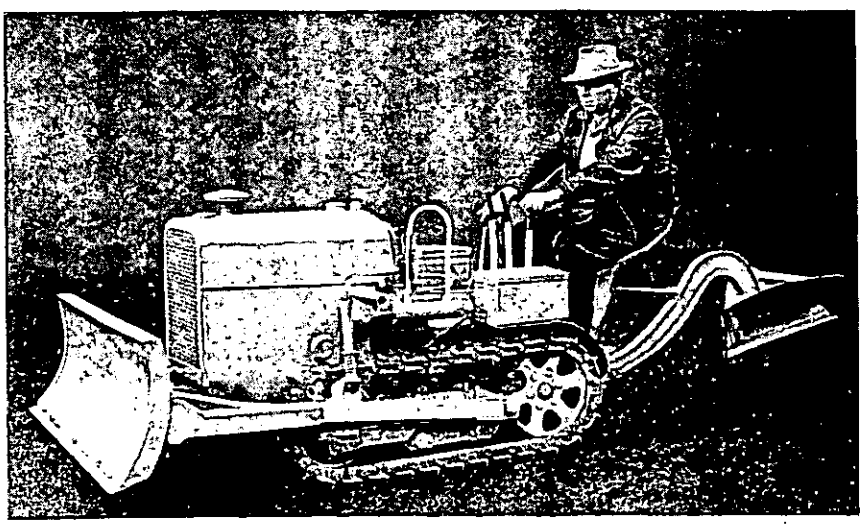
THE BEETLE TRACTOR

North Pacific Region—U. S. Forest Service

In various regions, during the past 10 or 15 years, there have been sporadic plans and trials aimed at machine maintenance of trails. On several forests in Region 6, small conventional tractors have been used to build or maintain "tractor trails." In general these turned out to be wider and more expensive both to build and maintain than the required service justified, and created drainage problems out of line with trail standards and costs.

In 1940, the Region 6 Trail Tractor was first used on heavy trail construction on the Siskiyou. It produced an excellent trail of satisfactory standard through difficult terrain at reasonable cost. The war interrupted progress on this network but work will be resumed in 1946 using the Clarkair military model developed by the Army from the original R-6 machine. Conclusions drawn from this project are that the 4,300-pound Clarkair is fully satisfactory for trail construction but larger and heavier than required for maintenance or for betterment and rehabilitation of existing trails.

As a result of experience with the 4,300-pound tractor, it was thought advisable to go to a still lighter machine for trail maintenance and betterment. In 1944 the equipment laboratory was requested to design a rugged, heavy duty unit not over 27 inches in



Wide gage beetle tractor with Wescoatt plow.

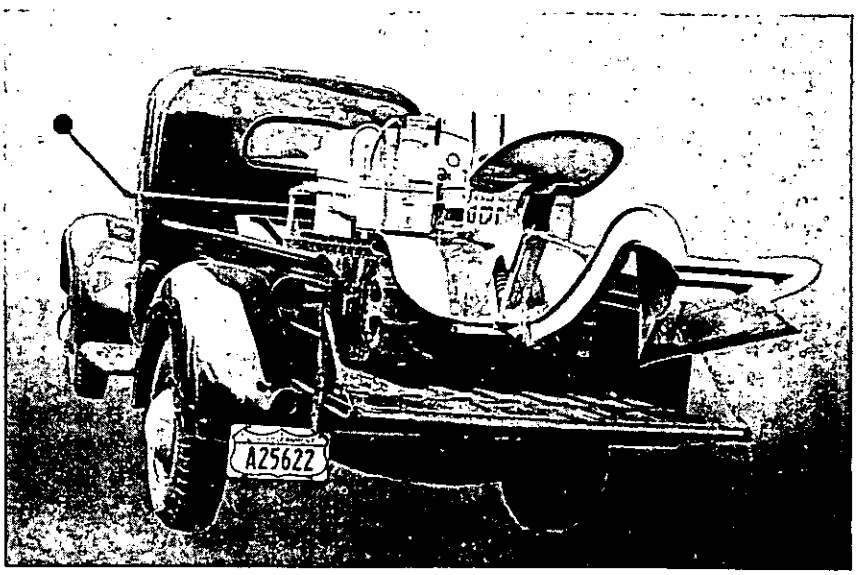
tread width, 84 inches long, with full hydraulic bulldozer, ample power, and light enough to be hauled in a pick-up. It was specified that basic tractor design should be followed insofar as practicable and commercial assemblies utilized to simplify parts procurement and repairs.

The equipment laboratory proceeded in line with the above general specifications. Design of the tractor was completed in December 1944, and plans turned over to the Portland departmental shop for fabrication. The pilot unit was finished in June, 1945. In order to differentiate it from other small machines it was christened the "Trail Beetle," which seems reasonably appropriate in view of its size and general appearance.

Beetle No. 1 was started out on the Clackamas River district of the Mount Hood. Work included removal of slough, windfalls, rocks and roots, widening narrow spots, rebuilding switchbacks to 6-foot radius, removal of puncheon and turnpiking wet spots, replacing bridges with fills, and other miscellaneous work ordinarily included in annual trail maintenance. During the course of the tests more than 20 miles of old trails were worked over and the machine was not "eased along." On the contrary, to determine weaknesses of design it was frequently put into situations beyond its capacity. Practically none developed. Results on trail rehabilitation were, in general, excellent.

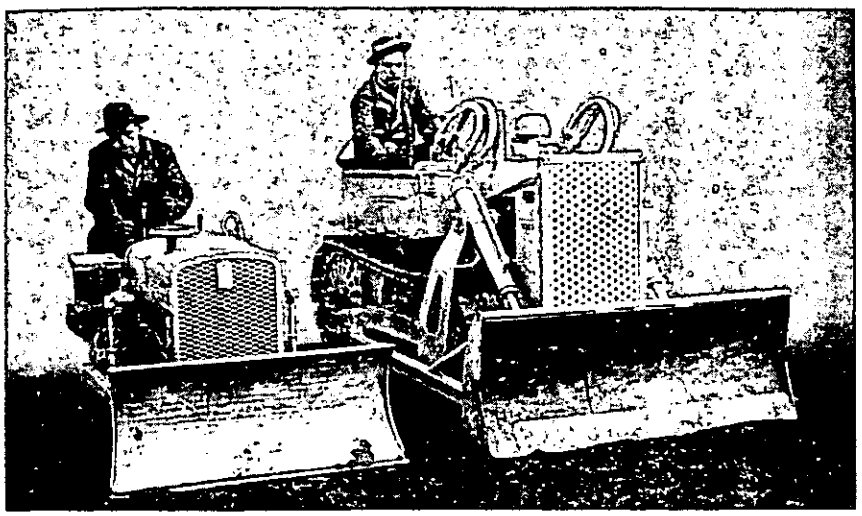
Plans are now under way for procurement from commercial sources of the beetle tractor with spare parts and it is hoped they will be available for the 1946 season.

This machine is primarily a trail worker but its small size and light weight offer fire-control possibilities in initial attack, and supplementing hand work until larger tractors can be delivered to the fire.



Wide gage beetle tractor loaded in pick-up.

Two narrow gage (27½-inch) beetle tractors are now available for use. A third, wide gage (32¾-inch) machine is undergoing tests for fire line construction. It now is equipped with a small Wescoatt plow. A disk plow will also be built and tried out behind it. In addition, it is planned to design a rotor attachment for trial use with this tractor.



Comparative size of the 1,800-pound 27½-inch gage trail beetle and 4,300-pound Clarkair.

Specification—Beetle Tractor

	Narrow gage (trail use)	*Wide gage (fire use)*
Weight, without bulldozer, pounds	1, 500	1, 530
Weight, with bulldozer, do	1, 800	1, 850
Over-all width on tracks, inches	27½	32¾
Over-all track length, do	51	51
Length of track on ground, do	36	36
Width of track plates, do	5¼	5¼
Width of bulldozer blade, straight, do	43½	50½
Width of bulldozer blade, angled, do	37	45
Over-all length with bulldozer, exclusive of seat overhang	82 inches.	
Seat overhang	22 inches.	
Motor, make	1 CK Waukesha, gas.	
Motor, horsepower	12–14 b. hp.	
Drawbar	1,600 pounds—10 hp.	
Speeds, m. p. h.:		
Forward:		
First gear	1. 69	
Second gear	2. 68	
Third gear	4. 91	
Reverse:		
First gear	2. 19	
Second gear	3. 41	
Third gear	5. 60	
Average gasoline consumption, per hour	¾ to 1 gallon.	

THE FIRE FLY PROJECT

NEAL M. RAHM

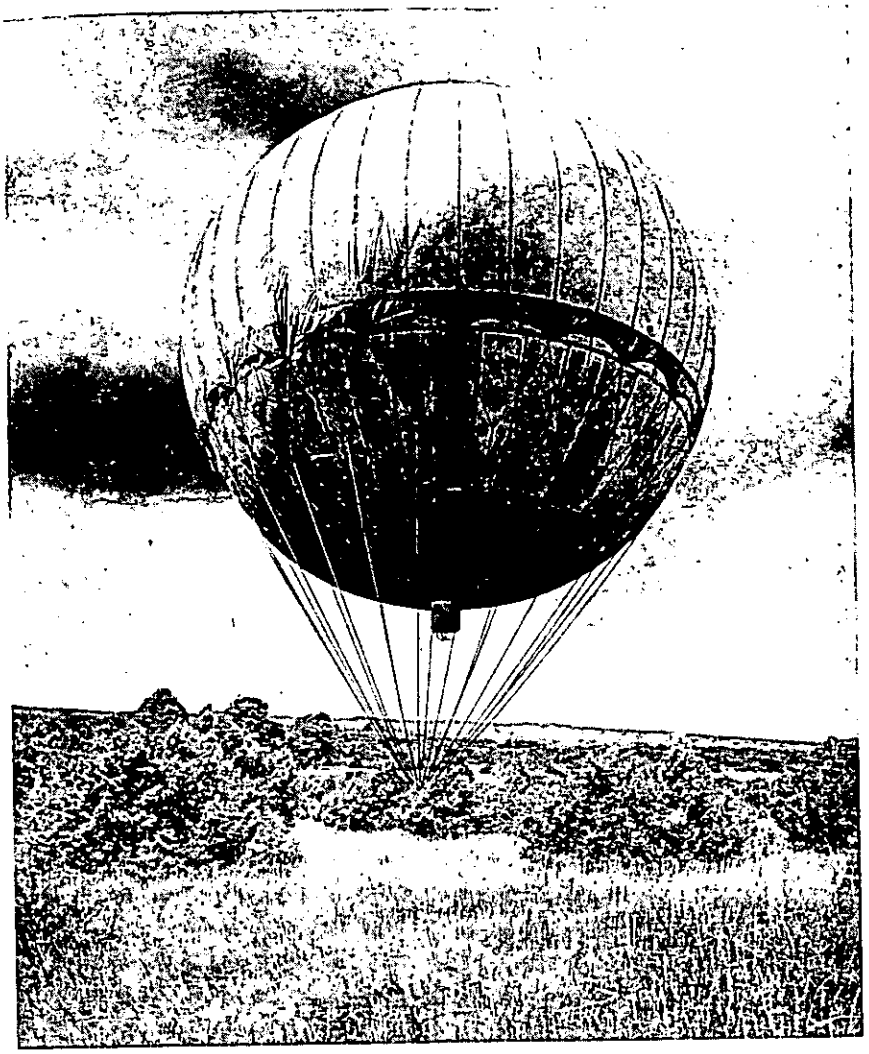
U. S. Forest Service, Liaison Officer, IV Air Force Headquarters

During the winter of 1944–45, forest supervisors and rangers in the western Regions were startled and concerned upon discovering they were actually under bombardment by enemy incendiary missiles and antipersonnel bombs. Free sailing, unmanned, paper balloons carried the bomb load which consisted of five cannisters filled with thermite and one large finned bomb containing shrapnel or three "fire pots."

District Ranger Raymond L. Beals and several inhabitants of Hayfork, a mountain town in northern California, narrowly escaped serious injury or death when the hydrogen-filled envelope of one such balloon exploded while landing in a tree. The recovered parts of this balloon and a complete unit discovered at about the same time by Supervisor Melvin E. Barron of the Modoc Forest were of vital interest to Army Intelligence. From these balloons and others recovered over a dozen western States, accurate information was rapidly assembled. They were being launched from Japan proper. Crossing the Pacific on wind currents at stratospheric levels, they reached the west coast in 80 to 120 hours. Most of the 298 recovered landed on the west coast, including Alaska, Canada, and Mexico, while a few went as far east as Michigan. An automatic device, controlled by aneroid barometers, dropped ballast and bombs.

The two objectives of the Army were rigid censorship to prevent the Japanese from learning if or how the attacks were functioning and destruction of balloons before the payloads were dropped. Censorship was remarkably successful. Leaks occurred late in the season, only when a woman and five children were killed in Oregon, and when an antipersonnel bomb exploded in an abandoned rock quarry near Santa Barbara. The Japanese, however, secured very meager information. They soon regarded the project as unsuccessful and, by April 20, 1945, abandoned the balloon attacks.

In the meantime, Federal and State agencies developed a system of detection and alerts which worked moderately well. Army air bases were kept sharp by numerous false reports. When the planet Venus became visible during daylight hours she was the target of 18 separate sorties in a single day. Experienced combat pilots claimed the balloons were difficult targets and could outfly a P–38. Near the Mexican border two Marine pilots and a salvage crew were dispatched to bring down and recover a balloon. At the first pass the pilots tried to place a short burst in certain apparatus to make the mechanism ineffective before "fanning" the envelope down with the "prop wash."



Japanese paper balloon.

They succeeded only in knocking off a few ballast sacks of sand which let the balloon rise to stratospheric levels. It was finally overtaken at an elevation of 40,000 feet where a brief burst and a blinding flash completed destruction. The explosion was so severe that the salvage party was unable to recover a single fragment.

Forest Service and other Federal and State agencies were gravely concerned. With the fire season but a few months ahead, the potentialities of the continued use of the incendiary missiles plus the possibilities of phosphorus leaflets warranted alarm. Never in the history of the Forest Service had there been such a dearth of men physi-

cally qualified to fight fire. The Washington office was requested to secure military assistance, without which the suppression problem appeared formidable. The Army was agreeable and designed a plan to provide assistance to civil agencies to combat forest fires started either by balloons or other causes. The Forest Service was designated to represent all fire protection agencies in the formulation of plans and operation of the project. Frank J. Jefferson, Assistant Regional Forester in R–5 was assigned the job of coordinator.

The Forest Service, together with the Fourth Air Force, Western Defense Command, and the Ninth Service Command devised a joint air and ground assistance plan. It was called the Fire Fly Project. It provided for troops specially trained and equipped to suppress fires. It further provided for air assistance in two forms: Reconnaissance planes and personnel to detect fires; and transport planes to carry paratroops to remote, inaccessible fires, supplies to fire fighters in such areas, and ground troops and Forest Service overhead where such transportation saved time. By May 19 the 3171st Eng. Fire Fighting Battalion (Prov.) consisting of 10 companies and 2,700 troops was organized. The 555th Inf. Paratroop Battalion consisting of 300 men was ordered for duty—200 stationed at Pendleton, Oregon, and a detachment of 100 at Chico, Calif. The First Troop Carrier Command with 7 C–47 planes was assigned the job of transporting personnel and cargo. The 161st Liaison Squadron furnished 32 L–5 and C–64 type planes and pilots for fire detection patrol flights and scouting activities.

Shortly after this activation, the State Foresters group, the National Park Service, and the United States Forest Service searched their personnel for the best training talent available. These men were thrown into one of the most intensive training tasks ever confronting fire protection agencies. The job of training 300 paratroopers, as well as 2,700 ground troops, was a real challenge. The paratroopers were given essentially the same training as the ground troops, to which was added a course in "smoke jumping"—one similar to that given regular Forest Service crews. The principal difficulty was weaning them away from Army methods which were not always adapted to our conditions. The Army used smaller chutes, dropping men rapidly from relatively low elevations and usually on flat terrain. The Derry chute developed by the Forest Service was larger, dropped more slowly, and could be guided by ropes attached to slots in the canopy. Up-drafts over rough terrain frequently held the chutes stationary in the air, or in some cases caused them to go up instead of down. This had an unnerving effect upon the colored paratroopers. In a few instances the men attempted to climb the shroud lines to determine what was holding them up.

By early July, troops had been trained and moved to their assigned camps in N. F. Regions 1, 5, 6, and 4. General areas were determined by the degree of existing potential fire hazard, and specific locations were, with one exception, at air bases of the Fourth Air Force or at camps adjacent to bases. These were picked to facilitate air movement of troops. Two fire control sections, one at Silver Lake, Wash., and the other at San Francisco, Calif., were established and repre-

sentatives from the Forest Service, Ninth Service Command, First Troop Carrier Command, 161st Liaison Squadron, and the Fourth Air Force were on deck, prepared to coordinate the efforts of their commands.

Shortly after the first of July, severe lightning storms opened the fire season with a bang. A fire situation developed in Region 5 and Region 6 which at times exhausted all Fire Fly personnel in these regions. Troops were flown from Camp White, Pendleton, Spokane, and Chico to fires in Oregon, Washington, and California. All units received their baptism by fire and functioned well. During the first 2 weeks of July, the Troop Carrier Command carried 70,000 pounds of cargo and 681 men. On the Klamath Forest in California, 800 men were subsisted by aircraft; 17,000 pounds of food and equipment being parachuted to them during a single day. The disastrous Wilson River fire in the Tillamook area in Oregon started at this time and was not controlled until the early part of September. During the latter part of July, all Fire Fly personnel were withdrawn from this fire and a regiment of Army engineers took over suppression work on a project basis.

In August, two bad situations developed in California, again caused by lightning storms. These same storms aggravated existing serious fire problems in Region 6. Regions 1 and 4 also exhausted all their units at one time during the month. The fire season terminated, or was sharply reduced in Regions 1, 4, and 6 during the early part of September, but because of high winds and low humidities, serious suppression problems continued throughout September and into October in Region 5.

An innovation to our general use of parachute attacks was jumps in force. In one instance 100 troopers and full equipment were dropped as a follow-up on a 300-acre fire in the Chelan National Forest, Wash., where the initial attack by 10 Forest Service smoke jumpers failed to hold the fire. For the first time in the history of Region 6, a large fire in this inaccessible location was controlled within the first burning period. Another mass jump by 50 men was made in the rough Mount Baker area in this same region, but for the most part 6 to 12 men were jumped on single fires.

Total military effort for the four western regions amounted to 147,562 man-days of fire fighting. They suppressed or assisted in the suppression of 282 fires. The paratroopers contributed 4,012 man-days of this total and worked on 28 fires. For their share of the effort, the troop carriers dropped 178,974 pounds of cargo and transported 2,313 personnel. The Liaison Squadron reported 145 fires, 5 balloon incidents, and flew 3,905 hours on 1,978 separate sorties.

The cooperation and coordination required to make the organization function efficiently was remarkably good. The fire record of 1945 reflects the success of the organization. The Fire Fly project, with its joint control by several branches of the Army and the Forest Service, all working together toward a common objective, will remain forever unique in Forest Service history.

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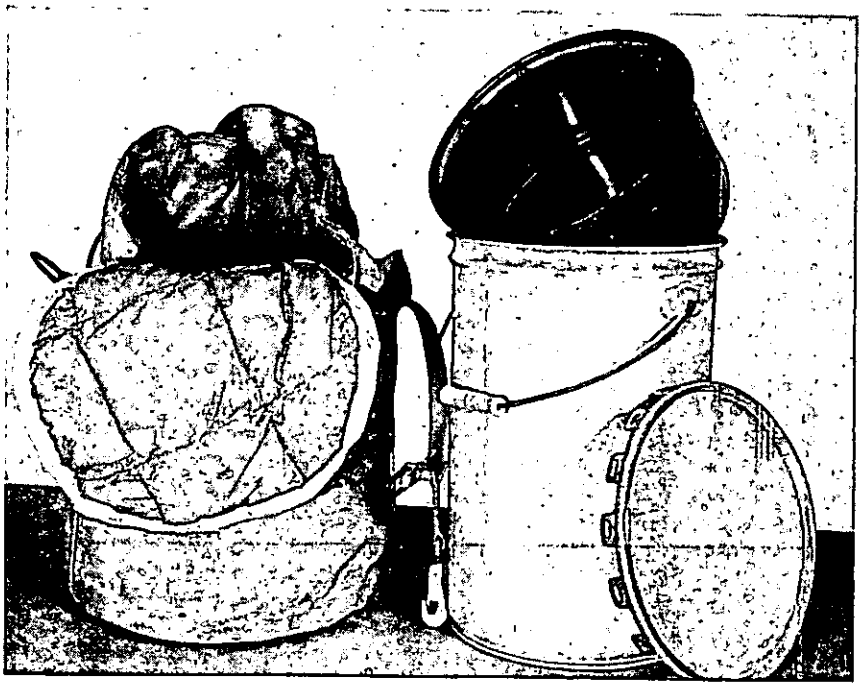
AIRPLANE DELIVERY OF HOT MEALS

RALPH S. SPACE

Northern Region, U. S. Forest Service

How many times have cooking outfits, complete with rations, cooks, and flunkies, been moved into fire camps only to serve one or two meals? When the costs of setting up a kitchen, packing in and out, cleaning up and repacking the mess outfit, and cook and flunky wages, etc., are added up, the cost per meal is enormous. In addition to these costs, time and energy have been lost hiking from the fire line to a camp for meals. Rarely is it possible to establish a camp right on the fire line. More often anywhere from 30 minutes to an hour or more have been lost hiking to and from work.

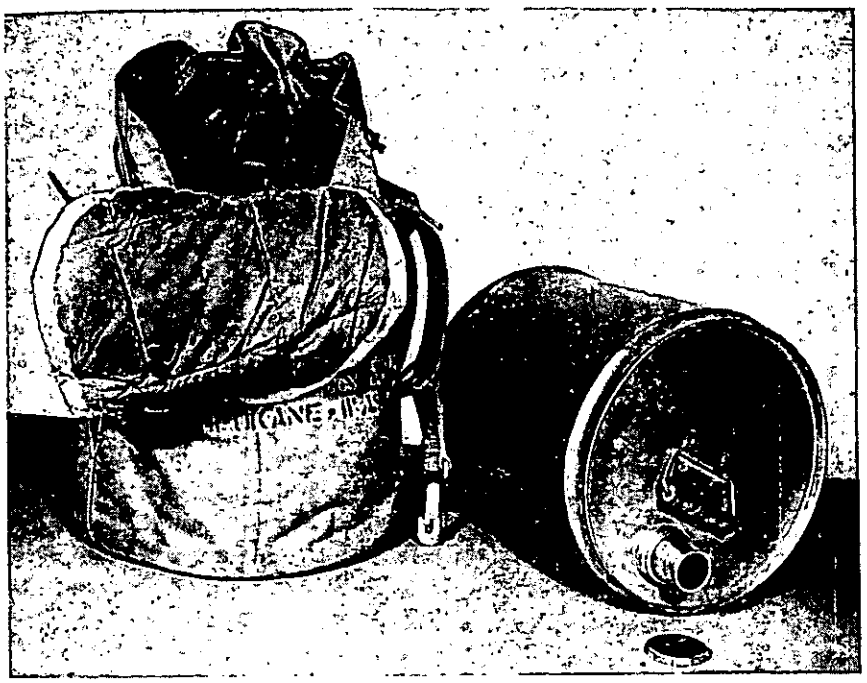
To cut losses in time and energy, in particular, and in some cases to feed fire crews more economically, Region 1 designed containers for delivery of hot food by plane and parachute. The method included the use of new inexpensive 5-gallon paint cans, enclosed in kapok cases,



Hot food container with kapok bag for insulation.

much like those in which ice cream is packed, except that each of these containers is provided with two or three compartments as needed instead of one. Food packed by this method has been kept hot 4 hours, which is ample time to fly it from Missoula to any point in the region. The over-all cost of each container unit (which includes paper dishes, paint cans, and protecting bags made from condemned kapok beds) is about $5. The unit can be abandoned in the field if the situation warrants.

Almost any type of meal can be furnished and menus are varied. For instance, a dinner may include meat—fried, roasted, or in a



Hot coffee container with kapok bag for insulation.

stew—mashed potatoes, peas, and gravy. If stew is furnished, gravy is omitted. Such a meal requires two containers of two compartments each. Hot coffee or a cold drink is furnished in the third container, which is equipped with a flexible spout. The food is prepared in a local restaurant and packed in the containers.

The saving in time and energy with small crews has indicated the possibility of delivering food in such containers to crews on large fires. However, certain problems, such as how to drop the containers safely through the heavy smoke blanket that hangs over large fires each morning until about 10 a. m., will have to be worked out. For small crews, though, the economy of delivering hot meals by parachute is now well established.

In 1940 an old fire boss was sent with 25 men to control a fire on top of a fairly high peak. They started early in the morning, backpacking their tools and 1 day's rations. It was a nip-and-tuck battle and around 5 o'clock in the afternoon the fire boss radioed that he had the fire under control but did not dare leave it for the night. He also reported that they had only enough food for one meal, breakfast, and very little water. Could it be arranged to send some food by parachute so he could stay overnight and mop up the fire early the next day?

"Sure," the dispatcher replied; "what do you want?"

"Well, I am not particular. Just something to eat and drink."

"How about roast beef, mashed potatoes, gravy, peas, and coffee?"

"Huh? Oh, yeah! Sure; and you might send some ice cream."

Within 2 hours he was greatly surprised to get it all, including the ice cream.

Coated Binoculars.—The first report to reach Region 3 on the use of "coated" binoculars came from District Ranger Dean M. Earl of the Apache National Forest. Although he knew there had been quite a little discussion on the coating of optical instruments, he had seen no accounts of tests made under forest conditions. So when he received a pair of B & L 7 x 50 binoculars which had just been coated, he made a few comparisons.

In his report, Ranger Earl states that the greatest single improvement lies in their use in looking toward the sun. As long as the sun does not actually enter the image, there is almost no glare. Objects nearly in line with the sun, that are only a blur to the unaided eye, stand out sharply through these coated optics. He believes that this improvement alone is well worth the cost of coating. He says that although the coating does not screen out haze, the increase in sharpness of the image is such that the effect of haze is greatly reduced. He also says the coating increases color definition, increased depth perception makes it possible to determine smoke location more accurately, and increased light transmission makes it possible to see into shadows that you could not penetrate with uncoated optics.

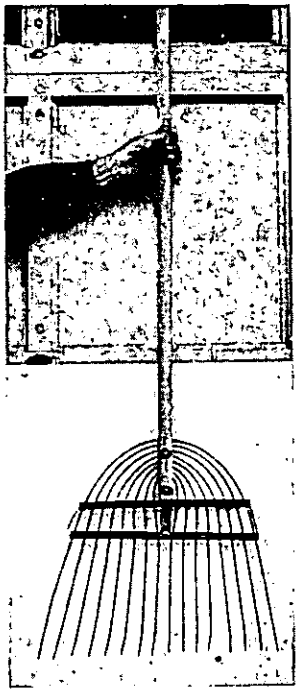
Ranger Earl believes much is to be gained in fire detection by the use of properly coated binoculars in lookout towers.

THE BROOM-RAKE FOR LINE CONSTRUCTION

PERLE LEWIS

Forester, Clark National Forest,
U. S. Forest Service

Every known style of broom-rake on the market has been tried on the Clark National Forest for line construction, but only one has stood up over the years under rough use. After 9 years' use on more than 9,000 fires, the simple tool illustrated on this page is still preferred over the heavier Kortick and Council tools which it replaced for fire-line raking in leaf-type fuels. Several other forests in this region also prefer this broom-rake.



Broom-rake for fire-line construction used on Clark National Forest.

Advantages

Advantages of the broom-rake are:

1. The light weight makes it less tiring to use. The simple broomlike stroke requires no back bending, and the steel tines bend over and around stones and roots instead of hanging on or moving them.
2. The tool is more effective than other rakes because the long spring tines reach between or under rocks, roots, or logs and move the leaves, twigs, and small branches down to mineral soil.
3. Line construction with the broom-rake in leaf fuel averages 6.5 chains per man-hour as against about 4 chains with heavier rakes.
4. The broom stands rough use well, although it is not as sturdy as other raking tools. The average rake can be used to construct about 160 chains of line before becoming unserviceable. However, when the average cost of constructing 160 chains of line is considered—$18 with heavier tools against $10.80 with broom-rakes—the expenditure of the 40-cent rake is amply justified.

Defects

Two defects of the rake are being studied at present. One is the weak attachment of the handle to the rake; the other is the slipping of the tines from one side of the rake to the other.

The rake shown here is manufactured by the General Hardware Co., 3618 West Pierce Street, Milwaukee, Wis.

TESTING ARMY EQUIPMENT FOR FIRE CONTROL USE

GEORGE A. MACDONALD

Washington Office, U. S. Forest Service

In the fall of 1944, a committee representing the Divisions of Fire Control and Engineering and the Branches of State and Private Forestry and Research inspected the many equipment items exhibited in the depot of the Quartermaster Board and selected seventeen as possibly suitable for fire control use. Samples of these seventeen items were sent to various regions for study and testing. Following is a brief description of each item and regional comments:

Packboard

A molded plywood frame, with laced canvas back piece, web straps, hooks and lash rope. Principal advantages are: good ventilation and load distribution, no protruding side members to chafe the wearer's back or hips, and very satisfactory lash hooks. A pack bag can be attached easily if desired. Moisture does not appear to affect the plywood. This packboard is considered well adapted to Forest Service work and superior to the well-known Trapper Nelson and other canvas-lined packboards.

Signaling Mirror

A 4″ x 5″ mirror of highest quality tempered glass. At the center is a window with a small red reflector, hinged at an angle to the mirror. The "red spot" produced by the reflector enables the user, looking through the window, to line up the mirror with the target so that the flash can be seen. Region 6 tested the mirror by signaling from one lookout to another, from a smokechaser to a lookout, and from the ground to aircraft. Considered so satisfactory that the region desires 1,000 mirrors if they can be obtained at small cost.

Smoke or Dust Goggles

Region 5 found these goggles quite satisfactory where smoke or dust was troublesome.

One-Quart Collapsible Canteen

Made of plastic-impregnated fabric, encased in a canvas bag. Has plastic neck and cap. Weighs 9 ounces. Region 5 tested it with the usual treatment to which canteens are subjected and found it durable.

When empty it flattens into a very small space and the neck and cap do not become bent, as frequently happens with metal canteens. The only disadvantages are that it cannot be filled by dipping it in a stream and the material gives a peculiar taste to water.

One-Burner Cooking Outfit

A nest of three aluminum kettles, the largest being 8 inches in diameter and 4½ inches deep, a frying pan, and a small gasoline pressure burner, with collapsible legs, which nests in the smallest kettle. The outfit is compact and weighs 3 pounds. Ranger Hugh Ritter, Region 6, used one of these outfits and found that the burner had to be pumped up every few minutes, with danger of tipping over, and that in frying the heat was not sufficiently diffused to the outside of the pan. He believes the outfit practicable for use where fuel is lacking or so wet that starting a fire is difficult.

One-Gallon Collapsible Water Bag

A gourd-shaped vinylite bag. To close the bag, the long neck is folded several times and secured with a plastic strap. The bag will hold air and makes a good pillow. This article, also, was tested by Ranger Hugh Ritter, Region 6, who reported it inconvenient to handle. It should be encased in a suitable canvas bag, with carrying strap. No information as to its durability is available.

Hand Smoke Signal

A distress signal, designated Mark 1, Model O, 1½ inches in diameter and 4 inches long. Weighs 8 ounces. Emits orange-colored smoke and burns 20 seconds. Region 6 tested it in open ponderosa pine and Douglas-fir timber, with a slight breeze blowing and excellent visibility from fire lookouts and ranger station. Results were as follows:

Distance:	*Period smoke visible (seconds)*
6 miles	15
19 miles	15
16 miles	25
20 miles (field glass used)	60
11.5 miles	120
4 miles	50

From all stations, smoke could be seen approximately 100 feet above the treetops. The smoke does not last long enough to serve as an effective signal by smokechasers, and unless the air is almost still it will not rise above the timber. Region 6 also tested other Army distress signals, obtained directly from the manufacturer, and will continue tests with these large signals in 1946, in an effort to obtain suitable signals for use as test smokes, for signaling by smokechasers, and to show the location of a spot for dropping supplies from an airplane when there is a layer of smoke.

Wool Sleeping Bag

Made of single wool blanket material. Weighs 3 pounds. Has parka top and 30-inch open-end zipper. Width near top is 27 inches, and at bottom 15 inches. The cover for the wool bag is made of waterproof material and weighs 2 pounds. It has a 34-inch opening, with grommets for lacing and also snap fasteners. Region 4 considers this bag not warm enough for the higher elevations, even in summer. Region 6 says it would be a reasonably good bed for a fire fighter in warm weather, but the open-end zipper would cause trouble and the grommets and snap fasteners on the cover are not as satisfactory as an ordinary zipper.

Mountain Sleeping Bag

Regions 1, 4, and 6 received two down bags, one weighing 4 pounds 8 ounces and the other 5 pounds 6 ounces. Both have parka tops. The lighter bag is 30 inches wide near top and 15 inches wide at bottom, with a 27-inch closed-end zipper. It fits the waterproof cover described under "Wool Sleeping Bag." The heavier bag is larger and may be intended for use outside the lighter one. It has a full-length zipper.

Region 1 reported that it believes the lighter bag is equivalent to the goosedown bag purchased by the Forest Service, but will not replace the kapok bag, as it is so thin that a bough mattress is needed.

Region 4 used the lighter bag with the wool bag inside it and the waterproof cover outside. To keep warm two thickness of Army blanket and a tarp were needed. They tested the heavier bag in a metropolitan bag, with air mattresses, inside a tent. Double wool blankets were used inside the heavier bag, which was about as warm as a 4-pound wool batt. They do not consider these bags suitable for Forest Service use.

Region 6 says the casing of neither bag is down-proof and the parka tops are unsatisfactory. The 6-pound goosedown bag, as purchased in Region 6, is better. They believe, however, that with some changes these Army bags, with a waterproof cover for each size, would serve as fire fighters' beds and it might be desirable to acquire them if the price was low. One bag inside the other is considered too warm in Region 6.

Field Range, M–1937

This item was tested in Region 6 and found to be unsatisfactory for fire-camp use. Its weight of 200 pounds makes it difficult to transport and the general arrangement of cooking features is not most practical.

Gasoline Cook Outfit

This outfit for small detachments was tried out in Regions 1 and 4. The pots, pans, kettles, etc. formed the stove lids and all openings must be covered to get circulation of the heat. This was inconvenient when cooking for a small group, because the unused openings had to be covered with containers full of water. Both Regions considered the outfit not suited for forest camp use.

Tent Stove, M–1941

A round, pot-type stove of cast iron, 18 inches in diameter and 17 inches high. Regions 1 and 6 concluded that with wood available the Sibley stove now used by the Forest Service is superior.

Officers' Mess Outfit, M–1941

This 8-man outfit was tried in Regions 4, 5, and 6. The case and utensils weigh 50 pounds. Region 4 reported the unit satisfactory when 6 or more men use it. Region 5 considered the outfit unsatisfactory because the enameled ware was easily chipped and constituted unnecessary weight. All agreed that the present Forest Service aluminum mess outfits are superior.

Army Company Field Desk

This desk is a metal-bound fiber case with compartments. One side is hinged to form a writing desk. Regions 5 and 6 concluded that the company boss box we now use meets our fire-camp needs better.

Immersion Water Heater

This heater, bootlike in shape and designed to burn gasoline, was tried in Regions 5 and 6. Both Regions report the unit inferior to other units used to heat water in fire camps, such as the Portable Water Heater described in FIRE CONTROL NOTES, April, 1946.

Food Containers

Regions 1 and 6 tested Army rectangular and cylindrical food containers for delivery of hot food to field crews. They concluded that insulated containers now in use on the national forests are superior and less costly. See description in FIRE CONTROL NOTES, April, 1946.

Army Type Ice Creepers

These creepers were tried in Region 1 and 6 as a substitute for calked shoes. The ice creeper is an expanding metal clamp studded with seven spikes. It is attached to the shoe by webbed straps at the toe, instep, and ankle. The Regions found them burdensome to the feet and generally unsatisfactory.

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FIRE PREVENTION PLANS

A. R. COCHRAN

Forest Supervisor, Jefferson National Forest, U. S. Forest Service

Fire prevention is one of the several ranger district activities that has many parts. These parts or jobs are like the pieces of a jigsaw puzzle. They don't make sense: all is confusion until they are put together in a plan. The relative position of any specific job is determined by the season and by the person who is responsible for it. When they are fitted together to make a plan, a picture of the whole fire prevention job on the district is obtained.

The plan gives the ranger a quick reference for current planning and shows who is responsible for what jobs at the time the jobs come up. The ranger carries his fire prevention plan in his master plan book. The supervisor finds the fire prevention plan an aid to inspection for quantity and quality of work because he has the whole picture before him and can inquire about any part to determine its status.

The fire prevention plan is produced under the Regional Fire Control Standard which requires on each district a study of the man-caused fires over the past 2 years and the preparation of specific action plans for preventing such fires. The plan consists of two parts:

A. Conclusions reached from study of occurrence records and special situations affecting fire occurrence.

B. Tentative assignment to individuals of all prevention jobs with time and place for each.

Part A, and 1 month of part B of the Holston Ranger District fire prevention plan, fiscal year 1946, are given below as a sample:

Holston District Prevention Plan, Fiscal Year 1946

Part A.

Fire Problems:

Pine Mountain Areas	5 fires annually, range burning.
Poor Valley	4 fires annually, smokers and campfires.
Currin Valley	7 fires annually, debris burning.
Sprouts Creek	3 fires annually, incendiary—since 1940—all in a high hazard area.
Konnarock and White Top areas.	These areas have had range burning fires and debris burning fires for 10 years.
N. & W. Railroad	5 miles of right-of-way.

Part B.

(1) Prevention Jobs:

Month	Job	Dispatcher hours	Top guard hours	Ranger hours
Feb.	Distribute debris burner prevention letter:			
	Prepare letter for mimeographing			2
	Determine list of addresses	2	2	
	Mail	8		
	Post contact record	2		
	Make personal debris burner contacts—Konnarock area		8	4
	Make personal contacts with specific debris burners (average of 20 per year)	4	4	4
	Contact law enforcement officers: 1 trial justice, 1 State policeman, 2 county wardens, 1 FBI agent, 4 game wardens		3	3
	Contact railroad officials to see if R/W hazard has been reduced		4	
	Show vocafilms to 18 graded schools		18	
	Maintain No. 1 poster display at 9 schools		6	

(2) Special Projects:

Poor Valley.—Patrolman make intensive contacts with fishermen in April and hunters in November.

White Top.—Fred Weaver contact range land owners each spring (5 days required). He will also make a special effort to "trail" the notorious Doc. Osborne.

Sprouts Creek.—Lookout A Thweatt make personal fire prevention contacts 3 days prior to each fire season. This area is noted for incendiarism.

A "SMOKE JUMPER" CREW AT WORK

Condensed from Region Four Report, by P. A. Thompson, Chief Division of Fire Control, Washington Office, U. S. Forest Service

The following is a brief account of the experiences and accomplishments of the 36-man "smoke jumper" crew stationed at McCall, Idaho, last summer. It was abstracted from a more detailed official report prepared by Region 4 of the Forest Service. It gives a good picture of the present status and potential value of aerial methods in roadless country in terms of on-the-ground experience.

In 1945 Region 4 of the Forest Service maintained at McCall, Idaho, a 36-man "smoke jumper" unit. These 36 flying firemen were trained to parachute from airplanes to fires in the forested mountains in that section of the Northwest. The area in which they parachuted to fires includes parts of three National Forest Regions, seven National Forests, and a lot of private lands. The topography varies from the flat sagebrush plains of southern Idaho to the rugged peaks and ridges of the Seven Devils in western Idaho, the Wallowa Mountains in Oregon, and the southern Bitterroots in northern Idaho. There is no more rugged terrain in the United States. It varies in elevation above sea level from 600 or 700 feet in the bottom of the Snake River Canyon to 9,000- and 10,000-foot peaks in the forests.

The crew was ready for business on July 1. Lightning fires started on July 11 and the first 2 jumps were made on a fire in the Payette National Forest. The season ended on September 16 when the last 4 jumpers walked out from the Fritzer Creek fire on the same forest. Between these dates men jumped to fires every week. Sixteen fires were handled in one busy week! The 36 smoke jumpers made 231 fire jumps on 66 fires. Of these fires 46 were suppressed by 2 jumpers; 12 fires required from 3 to 5 jumpers; 5 fires required from 6 to 10 jumpers; 3 fires required from 11 to 29 jumpers.

On August 2, 21 jumpers from McCall and 8 borrowed jumpers from Missoula parachuted to the Acorn fire. On this day the burning index was 73, which is extremely high; and winds varied from 10 to 30 miles per hour. The report states, "it was on this fire that the ground winds reinflated cargo chutes after landing and dragged 125-pound cargoes up 100 percent slopes." Nevertheless this fire was promptly controlled at less than 100 acres.

On September 2 on the Fritzer Creek fire the burning index was 85 and winds from 15 to 25 miles per hour. Six men jumped the first evening. On September 3 the burning index was 92 with increased winds. Nineteen additional men were jumped in one sector. The report states, "they alone stopped this fire on a critical 1-mile flank that was sweeping into adjacent drainages. The saving over ground crews here was probably 1,000 acres. The 25 smoke jumpers handled

the most difficult one-third of this fire at one-eighth the cost." On this day 31 of the 36 smoke jumpers were out on fires. Only 5 men were held on standby for call.

This was a busy crew. Between the first fire jump and the last fire jump there was a total elapsed time of 68 days. Sixty-eight (the number of days) times 36 (the number of men) equals 2,448—the total available man-days. The 36 jumpers spent 830 days on fires which is 34 percent of the total days. But this is not all—on those 830 days the men put in 5,025 overtime hours. This is an average of 6 hours overtime for every man-day worked. A good portion of this overtime was accumulated on Saturdays and Sundays. If the regular 8-hour days worked is added to the overtime worked we get 11,665 hours or an equivalent of 1,458 8-hour days. This means that for the 9-week fire season these 36 men *worked at fire suppression* the equivalent of 60 percent of the total man-days available, Saturdays and Sundays included.

The cost section of the report is of particular interest. For purposes of comparison, reports on fires which occurred in former years in fire weather, topography, and fuel conditions comparable to the 1945 fires were studied. A total of 33 comparable fires were found—the region describes conditions as "identical" with 33 of the 1945 fires. FF costs of the comparable fires suppressed by ground forces were $92,393 *more* than the cost of fighting the 1945 fires with smoke jumpers.

The total cost of the 1945 smoke jumper operation was $23,112. The men were C. O.'s so were not paid wages. A comparable crew will cost about $60,000 in 1946 at present wage scales. It should be worth the cost for, if it makes a record comparable to that of the 1945 crew, it should save at least twice $60,000 in FF and greatly reduce area burned.

No estimate is made of forest acres saved from burning in 1945 but the size class record of the 33 comparable fires with the 1945 fires follows:

	A	*B*	*C*	*D*	*E*
1945 Actual, smoke jumper-suppressed fires	23	7	2	0	1
1937–39 "Identical" ground force-suppressed fires	10	11	7	1	4

These figures are quite significant and considered with the cost records afford pretty convincing evidence that the aerial method of transporting men to fires in remote country is good business. If the manufacturers of helicopters will just hurry up and make available satisfactory aircraft of that type, the aerial method of "getting them small" can be extended to more millions of National Forest acres.

Approximately 220 hours flying was required to transport jumpers to fires and 40 hours for training jumps.

Twenty requests for jumpers could not be met because men were not available.

There were no lost-time accidents.

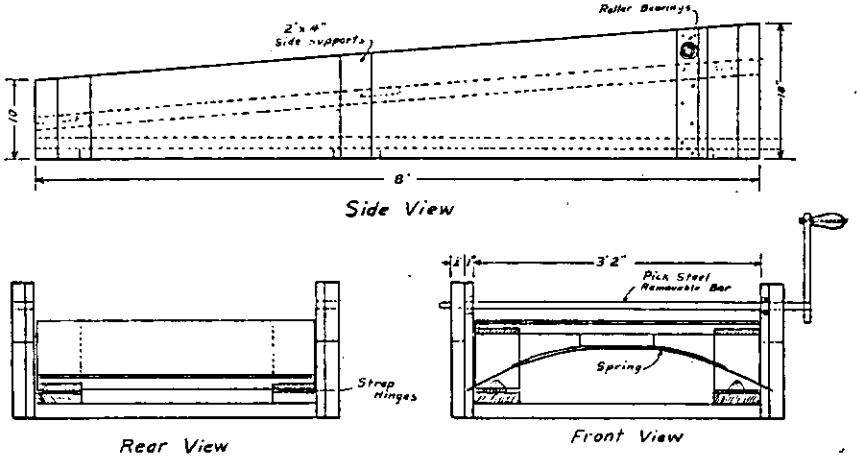
COSKI BED ROLLER

GLENN THOMPSON

Fire Control Staff Officer, Payette National Forest

Large quantities of fire beds and bedding are cumbersome to handle and store. Hand rolling them after cleaning is a tedious, time-consuming job and in transportation, particularly by air, their bulk usually has exceeded space limits before load limits have been reached.

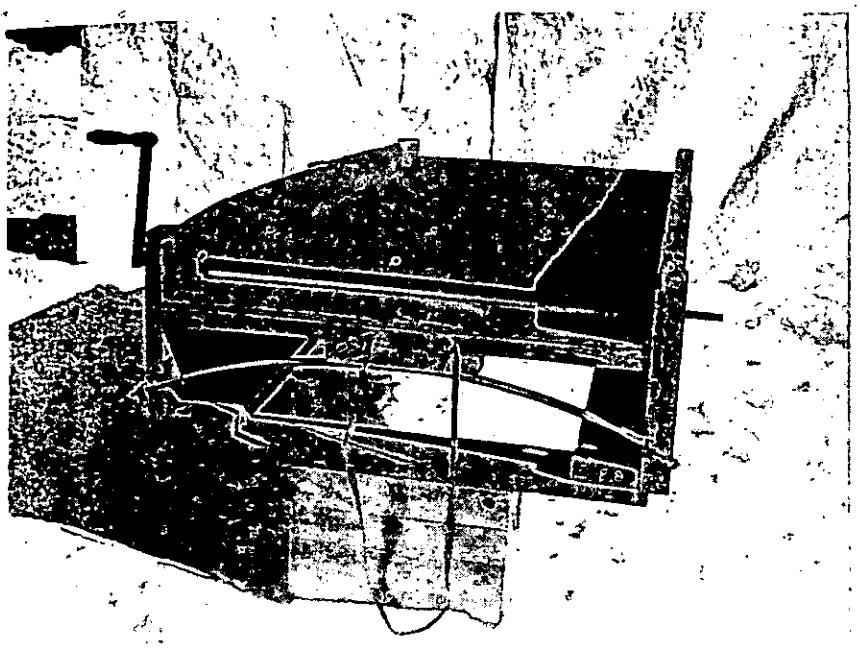
In 1938 when Thomas Coski, an experienced employee on the Payette National Forest, was confronted with the task of rolling



Coski Bed Roller

2,000 kapok fire beds for storage, he evolved the idea of a bed rolling machine which adapts the mechanical principles of friction and compression. Results were very satisfactory and the device has since resulted in great savings in time and storage space. The number of beds rolled has been increased from 10 by hand to 20 per man-hour by use of this machine. About a third more beds can now be stored in the same amount of space.

We use the machine for rolling all cotton, wool, and canvas materials as well as for kapok beds. The item to be rolled is spread on the platform and folded, if need be, into the desired length and width. One end of the item is then engaged around the square bar by hand and rotating is begun. The entire crankshaft assembly is pulled out after the completed roll is tied. Power rotation is now being adapted to the bed roller.



Upper end view of Coski Bed Roller with crank in place. Note position of compression spring which keeps bedding tight against roller and allows roll to increase in size.

Coski Bed Roller in use.

A PRELIMINARY SURVEY OF FACTORS OF VISIBILITY OF SMALL SMOKES IN AERIAL DETECTION[1]

WILLIAM G. MORRIS

Pacific Northwest Forest and Range Experiment Station, Portland, Oregon

With the trial use of airplanes as the principal means of detecting forest fires on a large portion of the Chelan National Forest in Washington during 1945, numerous questions arose concerning the principles that should be followed to obtain the best detection with a given amount of flying. Factors of visibility of small smokes from lookout stations have been previously studied and reported. The results of these previous studies were demonstrated and tested in September 1945 on the Chelan National Forest to show how they apply to aerial detection of small smokes.

As indicated by these previous studies two of the important factors which apply to the visibility of small smokes from airplanes are brightness or color of the background and angle between the lines of sight from the observer to the smoke and from the observer to the sun. Visibility of white smoke in full sunlight against dark backgrounds decreases gradually as this angle increases. Against a mottled background visibility is about the same as against a dark background for angles from 0 to 70° from the sun but the visibility decreases rapidly as the angle increases beyond 70°; against a light background the visibility is less and the optimum angle from the sun is about 40°. From this optimum the visibility decreases rapidly as the angle increases.

On first thought it may seem contrary to experience that a smoke as indicated above is more visible when looking toward the sun than when looking away from it. A person usually thinks of visibility in terms of common objects such as ridges and trees, which are less visible when looking toward the sun. The opposite is true of smoke.

This greater visibility of smoke looking toward the sun applies only to smokes in full sunlight. For all practical purposes the safe visibility distances of smokes in shadows when looking toward the sun is zero. When looking away from the sun the visibility is better but is still considerably less than if the smoke were in sunlight instead of in shadow.

When looking away from the sun smokes can be seen farther on a cloudy day than on a clear day, especially if looking toward a light background. On a clear day, the visibility is greatest when looking toward the sun unless the smoke is in a shadow. On a cloudy day the visibility distance when looking away from the sun is the same as when looking toward the sun.

The greater visibility of smoke in sunlight on clear days would indicate that under such conditions a plane flying low would afford a better chance to see a small smoke than if it were flying high, because the angle between the lines of sight from the observer to the smoke and

[1] Condensed slightly from the full article, containing references, which may be obtained from the Pacific Northwest Forest and Range Experiment Station, U. S. Courthouse, Portland 5, Oreg.

to the sun would be smaller. The facts concerning visibility of smokes on cloudy days would indicate that the plane could fly up or down either side of a drainage and have an equal chance to see a small smoke. On a clear day the side of the drainage from which the observer is looking most nearly toward the sun would afford the best chance of detection. In early morning or late afternoon, when there are shadows on the steep slopes, the chance of detecting a small smoke will be much less than during midday; thus, the patrol flights should be scheduled when there are no shadows on the hills. Broken clouds that cast deep shadows will also reduce the chance of detection.

Two series of tests were made. Test-smoke bombs or smoke candles were burned under various conditions of haze, position of the sun, and background, and their visibility was recorded from different positions and elevations by an observor in an airplane.

In the first series of tests, smoke candles were ignited one after another on the airport field to provide a continuous flow of smoke while the observation plane circling above gradually increased the radius of its circle to 5 miles from the airport and at the same time climbed to an elevation 14,000 feet above the airport. The observer made notes of the appearance of the smoke at frequent intervals and gave the position of the plane relative to the smoke and the sun from 9:45 a. m. to 11:20 a. m. The wind was very light but there was considerable drift of the smoke more or less horizontally. The sky was clear but the observer in the airplane was looking down into a haze layer which was rather dense in the valleys. The background for the test smoke was yellowish gray formed by gray gravel and a sparse stand of dead grass. The haze decreased with increasing elevation and the upper limit of it as seen from the airplane appeared to be at 10,000 feet above the ground.

The airplane observer made the following notes concerning the visibility of the smoke:

Horizontal distance of smoke	Elevation of airplane above smoke	Notes on visibility of smoke column compared to approximate horizontal angle between line of sight to smoke and to sun
Miles	*Feet*	
1	700	Clearly visible at all angles.
1	1,100	Difficult to see with sun at observer's back.
2	1,300	Clearly visible toward the sun and satisfactorily visible at right angles to sun.
3	1,700	Visible toward the sun and at right angles but barely distinguishable with sun at back.
5	4,000	Not distinguishable with sun at back.
5	5,000–6,000	Not distinguishable with sun in the 90° sector at observer's back.
5	6,600	Not distinguishable when sun in the 120° sector at observer's back and on the border line of visibility the shadow of smoke becomes visible before the smoke itself.
5	7,000	Identification of smoke not certain when sun slightly behind observer.
5	9,000	Neither smoke nor shadow discernible when sun at observer's back.
5	10,000–14,000	Barely seen when sun slightly behind observer but satisfactorily visible when horizontal angle between sun and line of sight about 45°. Most visible when horizontal angle 0°.

The second series of tests was made to determine the effect of several visibility factors and also to determine whether an observer looking for smokes but not knowing where they might occur would miss some of them when they are no larger than the test smokes used here. The smoke from the test-smoke candle is approximately equivalent to that produced by 200 square feet of burning Douglas-fir duff and continues to issue for 4 minutes. The test smokes were set off during a 2-hour period at unscheduled times and places in a steep forested valley 16 miles long and 5 miles wide while the observation plane patrolled above, the observer knowing that test smokes would be set off. Only one candle was set off at each place. The day was clear but there was considerable haze. The visibility distance measured with the Byram hazemeter was 11 miles looking toward dark timbered backgrounds of ponderosa pine, Douglas fir, and larch. The airplane flew at 3,000 to 3,500 feet above the bottom of the valley.

Seven out of 14 smokes were discovered. Those discovered were set under the following condition: One was in dense, tall timber, 2 were in moderately dense timber, 1 was in a patch of saplings, and 3 were on gray rock-covered ground. Those missed were as follows: One in moderately dense timber, 1 among scattered trees, 2 on the shady sides of small opening, 1 in a patch of saplings, and 2 on gray rock-covered ground. The smokes that were discovered appeared as thin wisps at some moments and as rather dense columns at others. On circling them they became less visible when the sun was at the observer's back.

During both series of tests the haze cutters developed by G. M. Byram were tried frequently. The dark red filter made the small, thin smokes examined, including that from one campfire, considerably less visible but improved the visibility of landscape features. The polarized smoked glass filter had no apparent effect on smoke visibility but improved landscape visibility.

The two series of tests substantiated the previous conclusions concerning brightness or color of background and the angle between lines of sight from the observer to the smoke and from the observer to the sun.

Several general observations of factors concerning aerial detection based on the first season of experience by pilot Gene Dolman and observer George Honey should also be mentioned. They state that about 1,000 feet above the ground is the best elevation when searching for small smokes. They believe it is impracticable for one plane to search large areas such as several hundred thousand acres for small smokes like the smoke candles. If it were suspected that small smokes, such as those from small lightning fires, were in the area a time-consuming, detailed search would be necessary. They believe the scanning method of using the eyes is better than the fixed direction or detailed examination method. Their experience indicates that the contrast of the smoke against the background will be detected at a glance and that prolonged looking at the same spot would not greatly improve the chance of detection but would exhaust the observer.

These men think that a great deal more area can be covered in a shorter time by flying across the canyons rather than up and down them. The value of this choice would depend on the size of smoke, the chance of periodic appearance and disappearance of the smoke, the lighting and background positions, and the period of visibility while a canyon was being crossed.

Several inherent characteristics of the northern Cascade Range country in Washington make aerial detection of small fires very difficult. In the higher mountains the exceedingly steep, rocky slopes and the variable directions of the drainages make only the uppermost slopes and the tops of the ridges visible to an airplane in search of small smokes unless each drainage is flown separately. A greater percentage of the area is visible in the more rounded topography and more regular drainages of the foothills. Another difficulty of detection in the higher mountains is the background color and lighting pattern. The timber occurs in patches and as scattered trees which give a mottled color and shadow pattern. Many of the higher ridges are bare granite which forms a light background from numerous angles of observation of smokes rising from the timbered gulleys and slopes below.

Inventory of State Fire Control Equipment.—A combined inventory as of July 1945 shows that the 42 States engaged in Clark-McNary cooperative protection of 301,228,000 acres of State and privately owned forests are using the following major equipment items:

Steel and stone lookout towers	1,867
Wooden lookout towers	546
Tree lookout cabs	105
Miles protection roads	33,710
Miles metallic telephone lines	22,137
Miles ground telephone lines	17,992
Tanker trucks	1,379
Transportation trucks	1,521
Tractors	486
Graders, bulldozers, and trailers	219
Mechanized plows	280
Portable power pumps	1,296
State-owned airplanes	5
Radios	2,172

The States of Maine, New York, New Jersey, Rhode Island, and Texas own and operate their own airplanes for fire control, but many other States use airplanes but on a contractual basis for similar purposes. Thirty-four States use radio in varying degrees.

McLEOD TOOL DEVELOPMENTS

LLOYD A. QUALLS

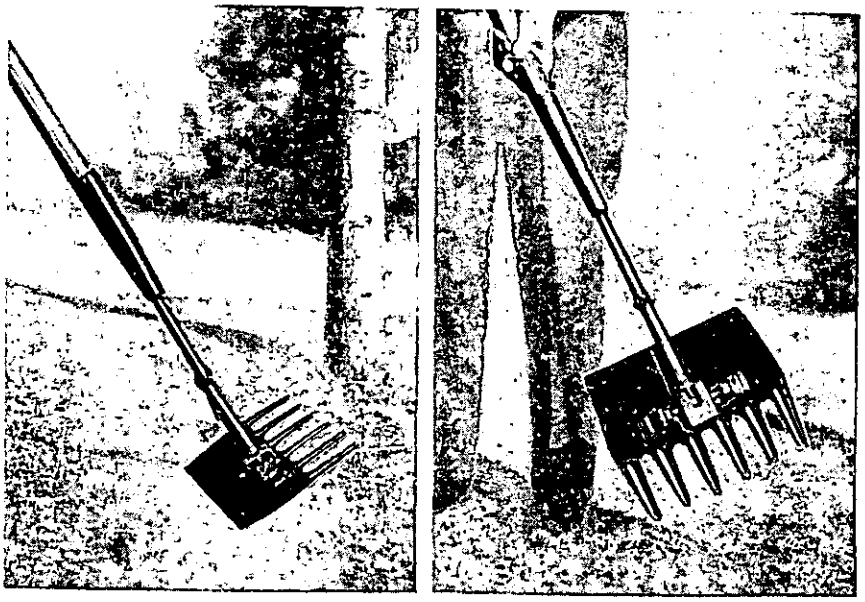
Equipment Operator, Trinity National Forest, U. S. Forest Service

Folding McLeod

The purpose in developing a McLeod tool with folding blade was to adapt the tool for more convenient packing, yet keep it in one piece.

A Kortick-McLeod was used. The triangular head of the shank was cut off and threads run up the desired length of the shank. The pipe sleeve, with keeper welded on, was slipped on the shank and the bolt used for a hinge pin welded across the end of the shank. This bolt is threaded on both ends, as the added area of the nuts on each end of the hinge pin is desirable for welding. To the nuts on the end of the hinge pins angle irons are welded and these in turn are welded to the blade. The slot cut in the channel iron is just wide enough to allow the shank to pass freely when the handle is raised or lowered. The channel iron is then welded to the blade.

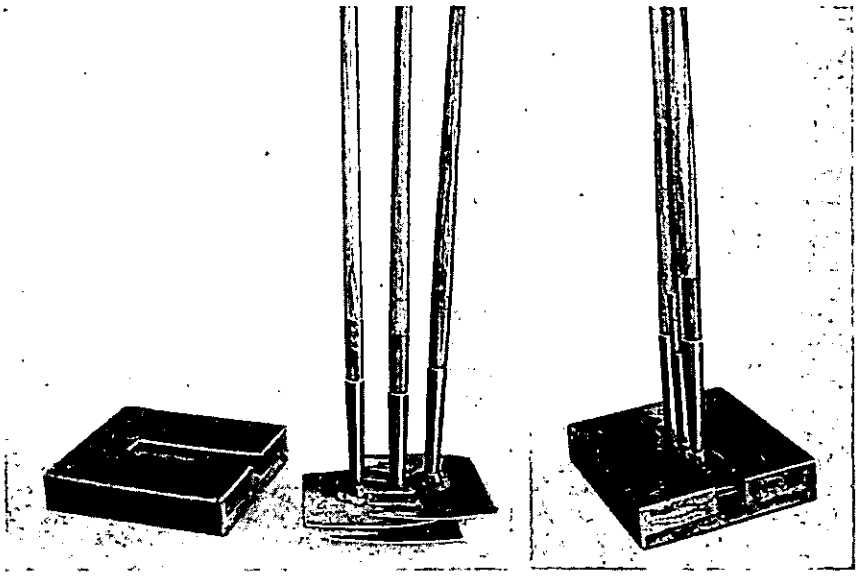
Changing over the tool adds a half pound to the weight, but less than one-fourth of a minute is required to change from the folded to the use position.



Folding McLeod tool—left, use position; right, showing folding device.

McLeod Tool Box

The McLeod tool box is made to hold three McLeod tools. Light, simple in construction, it does not use hinges, hooks, or lock pins of any kind. Inside measure is 2⅜ inches deep, 11 inches wide, and 13½ inches long. The top and bottom are of ¼-inch 3 ply. Sides and ends are made of ¾-inch material. The top has a slot 2 inches wide by 10 inches deep. The front end is made of two pieces 4½ x 1½ x ¾ inches. These are nailed to the top plywood, allowing for a 2-inch opening to match the top opening, and also providing an opening across the bottom of the front end.



McLeod tool box—left, tools and box; right, final assembly.

The tools are placed in the box one at a time, with the final assembly as shown in the photograph. Thus, the blade of the last tool in the box is held against the solid part of the front end, holding all tools in place. The handles are bound together toward the top with binder twine or rubber bands.

Combination Pulaski-McLeod

The head of a detachable McLeod tool can be attached to a Pulaski tool, thus enabling a fire fighter to carry a 4-purpose tool conveniently. The McLeod head can be carried easily in a sheath or pack and attached to the Pulaski in a few seconds.

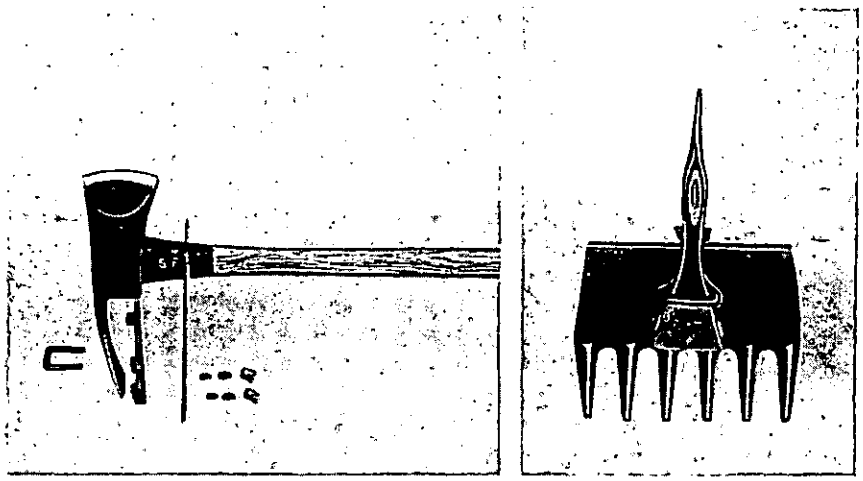
The following are needed to make the attachment:

One U-bolt, ⅜-inch stock threaded both ends, bent to fit ⅜-inch holes centered 2⅜ inches apart;

Wing nuts and washers for the U-bolt; two ⅜-inch holes should be bored in the tool head directly under the existing holes on the cut-

ting blade side, the hole centers to be 1⅜ inches from the center of the existing holes. The distance between the centers of the new holes should be 2⅜ inches;

An angle attachment—a piece of ¼-inch iron or steel triangular in shape. The small end has two prongs which fit snugly alongside the hammer end of the Pulaski to prevent side play. A piece of ½-inch iron is spot-welded to the main piece of metal, just below the crotch



Combination Pulaski-McLeod tool—left, unassembled parts; right, assembled and ready for use.

of the pronged end or "fork," giving the attached McLeod head the proper angle. At the widest or flared end of the attachment two pieces of ⅛-inch metal are spot-welded. The edges of these ⅛-inch metal "sideboards" rise about ⅜-inch above the flat surface of the attachment and act as side guides to insure against side play. The flared end at the widest point is 3 inches. The holes, as shown by the picture, are 2⅜ inches apart and act as the other side of the U-bolt clamp. The distance from the widest part of the attachment to a line drawn between the centers of the holes is 1¾ inches. The distance from the base edge to the crotch of the fork is 4¼ inches.

This attachment can be lightened by cutting out the center or by using a lighter gage stainless steel.

SHEATH FOR BRUSH HOOKS

HENRY SIPE

Assistant Supervisor, Cumberland National Forest, U. S. Forest Service

Many fire-control workers are required to carry single-edged brush hooks in their cars or other places where it is not possible to keep them in a protective slot. The sharp edge of the tool is likely to be dulled by contact with hard objects or may damage softer materials.

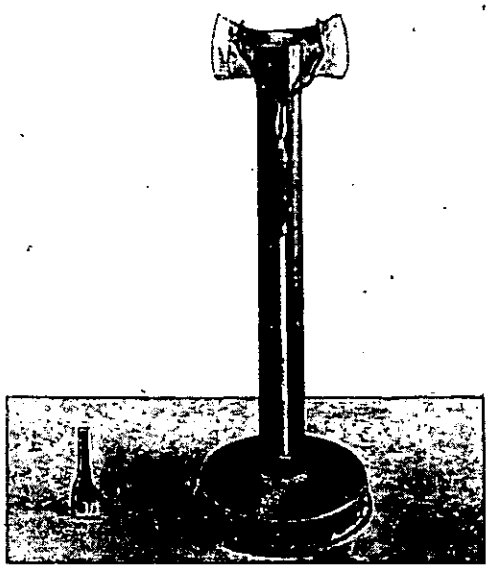
Sheath for brush hooks.

Not the least danger is the cutting of a shoe or finger. The author has never seen a commercial sheath on the market to protect the edges of these tools.

An effective and inexpensive sheath for a brush hook can easily be made by using material available to anyone. (See accompanying picture). Select a board about ¾ inch thick and as long and wide as the

cutting edge of the tool. Lay the tool on the board so that the edge and most of the shoulder of the blade is over the edge of the board. Then draw a pencil line on the wood along the blade's edge. Next saw a slot in the middle of the edge of the board as far as the pencil line. This slot may be widened with a sharp knife, file, or rasp, so that the tool edge will fit snugly. A hole should then be drilled through the board at such a point that a cord or strap can be inserted and tied around the blade to keep the sheath tightly fastened. The corners of the board can be rounded as desired.

Brush hooks commonly have various head or blade shapes and sizes. It is thus desirable and easy to make each sheath fit the particular tool it is designed to protect. A little sawing and filing will usually change the sheath to fit a tool of different shape.



Holder for dehandling axes, showing ax head in slot at top of pipe.

Holder for Dehandling Axes.—This implement is made of 2½-inch wrought steel water pipe welded to any base having sufficient area and weight, such as a truck brake drum or cat-track roller, to keep the holder vertical and prevent it from jumping. The finished height of pipe and base should be approximately the same as that of a workbench. A slot is cut in the top of the pipe on opposite sides about 2½ inches deep and wide enough to allow the ax head to drop in. The slot should be slightly V-shaped with the vertex rounded or squared.

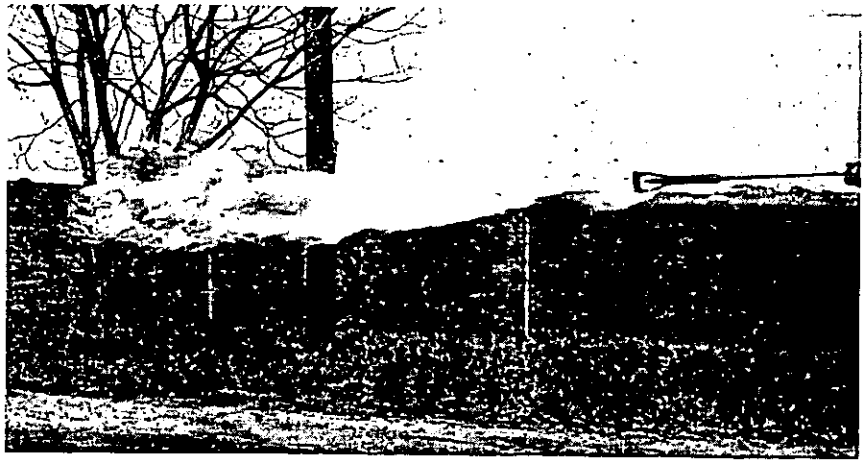
To remove the old handle, saw it off as close to the head as possible without running the saw against the ax—½ inch to 2 inches is a convenient length. Place the ax head in the holder with the wedges down. Use a handle knockout and hammer of about single-jack weight. It is not necessary to remove the wedges or drill holes. The shoulder of the handle does not need to be removed as the wood shears off readily without injury to the ax. A very tightly fitted handle can be removed in less than 1 minute.—Lloyd A. Qualls, Trinity National Forest, U. S. Forest Service.

NORTH CAROLINA FLAME THROWER

M. M. Carstarphen

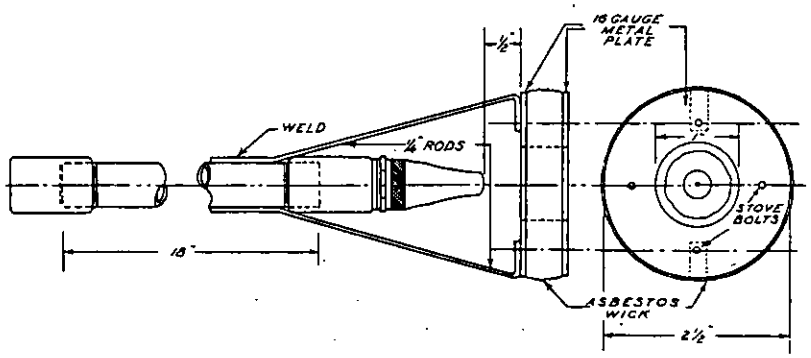
Acting District Forester, North Carolina Forest Service

The North Carolina Forest Service has developed an improved flame-thrower attachment for back-pack pumps. Its main feature is a flat disk asbestos wick with a 1-inch hole in the center, through which the kerosene fuel must pass. The circular flame of the wick insures positive, continuous ignition of the discharged fuel, a highly desirable feature.



Upper, North Carolina flame thrower in action; lower, construction details. (Photographs courtesy North Carolina Forest Service.)

The attachment consists of an 18-inch x 3/8-inch pipe extension tipped with a D. B. Smith Co. flame-thrower nozzle. A circular asbestos wick (2½ inches diameter, ½-inch thick, and with a 1-inch hole in the center) is mounted ½ inch in front of the nozzle tip. The wick is bolted between two 16-gage metal disks and held in position ½ inch in front of the nozzle by two ¼-inch rods welded to the pipe



Plan for making flame-thrower attachment for back-pack pumps.

back of the nozzle. The ends of the rods are flattened and bent in ½ inch and have ⅛-inch holes drilled so that the circular wick can be bolted to them. Details of construction are shown in photograph and drawing.

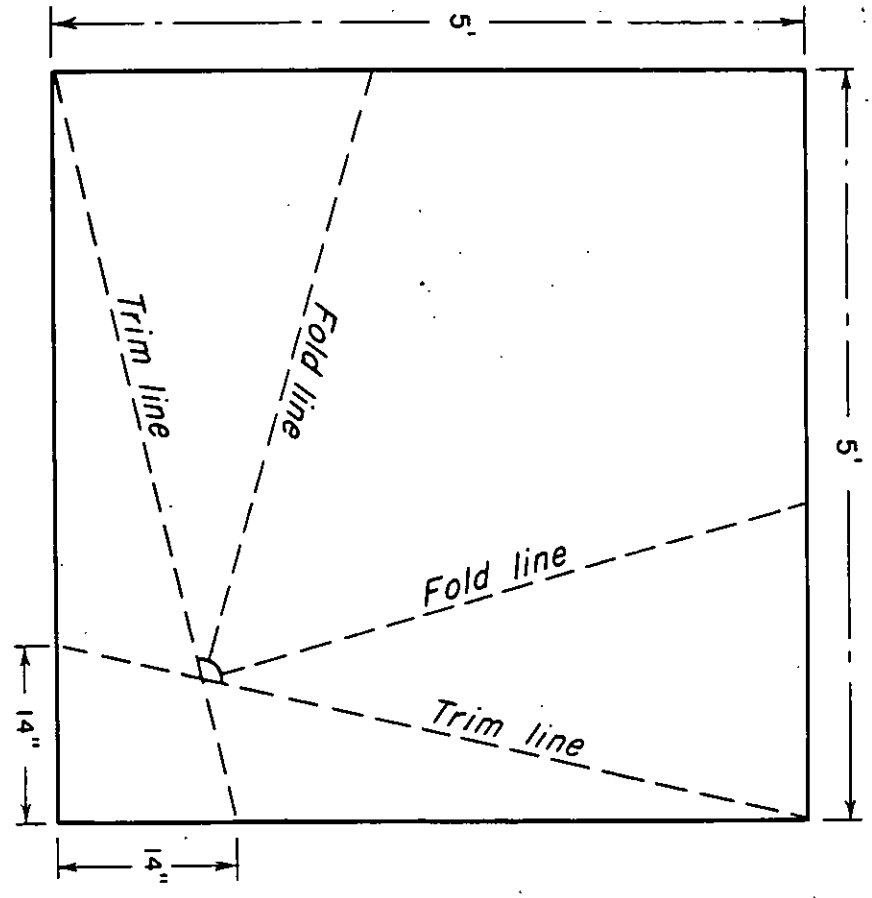
Some difficulty has been experienced in keeping the wick saturated during use of the flame thrower. But this can be overcome by placing the wick disk flat on the ground and permitting the kerosene fuel to fill up the center hole. However, a better method of keeping the wick saturated is needed.

CANVAS GRAVITY INTAKE

CURTIS E. PRICE

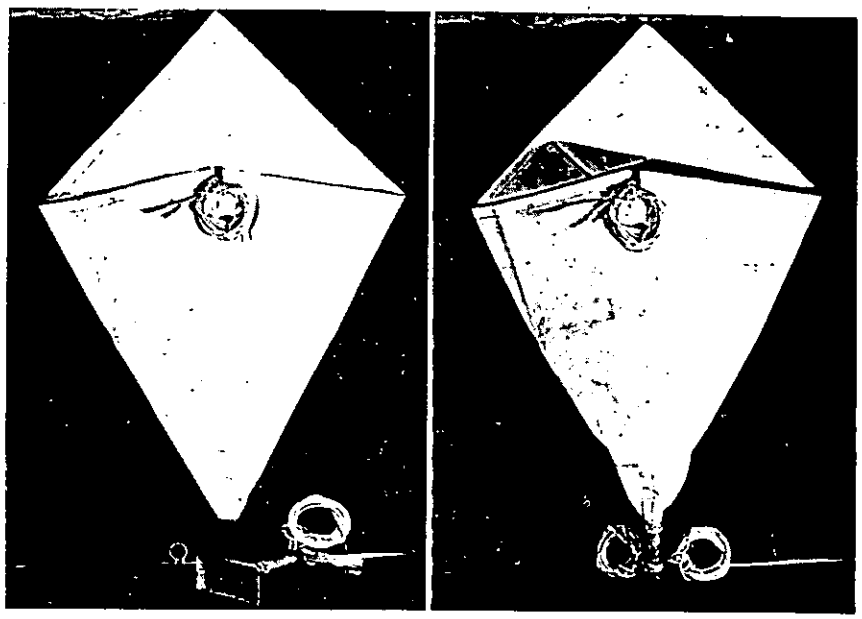
Forester, Siskiyou National Forest, U. S. Forest Service

In the summer of 1944 Ranger L. J. Cooper of the Siskiyou National Forest needed a funnel intake for a gravity water supply, something that could be installed quickly in irregular stream beds. He discussed it with Al Love, fire warehouseman, who made an intake, illustrated in the accompanying photographs, from a piece of 10-ounce canvas 5 feet square, cut and folded as shown in the sketch.



Specifications for canvas gravity intake. Trim lines are brought together and lapped 1¼ inches. The lap may be sewed or cemented.

In use, the long point of the canvas is weighted down on the creek bottom with rocks and/or mud. By means of the rope attached to the top side of the canvas, the funnel is anchored in such a way as to hold that side up out of the water. A metal funnel fits inside the canvas one and is fastened to it with a 2-inch hose clamp.



Left, the metal funnel, with screen, pipe nipple, and ropes; right, the gravity intake assembled.

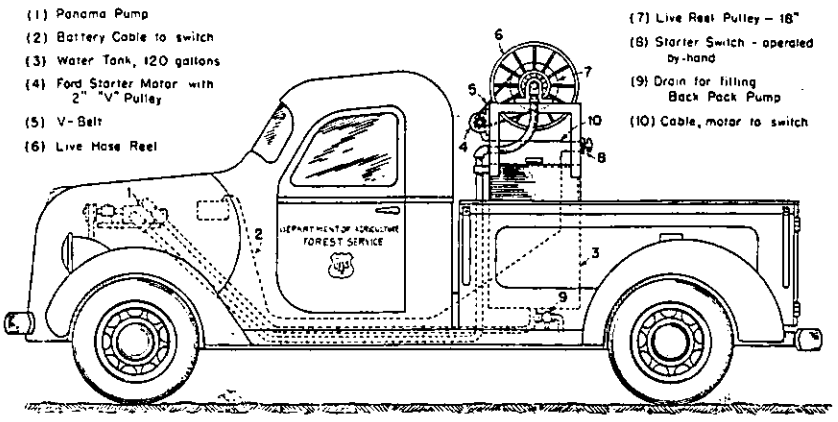
The opening to the metal funnel is 5 x 10 inches and is covered with ⅛-inch mesh screen. The outlet is brazed to a 1½-inch pipe nipple 8 inches long. A male hose coupling is welded to the outer end of the pipe nipple for the attachment of a standard 1½-inch hose. Two-inch rings are welded to opposite sides of the coupling for the attachment of ropes to anchor the intake and prevent it from being dragged by the pull of the hose. Tests indicate that this intake is better than any others tried on the Siskiyou National Forest for locations where the water supply is low and difficult to pick up.

LIVE HOSE REEL FOR PANAMA PUMP OUTFIT

M. S. SMOTHERS

Forest Mechanic, Jefferson National Forest, U. S. Forest Service

In 1942 the Jefferson National Forest provided each ranger district with a Panama Pump mounted on a ½-ton pick-up equipped with a 120-gallon tank and 500 feet of ¾-inch hose mounted on a reel. The vehicles were not set aside for exclusive fire-control use, but were employed by the general district assistant in his regular year-round work. Thus, during the fire season he was always equipped with the pump, hose, and a tank full of water. Frequent use has also been made of them in mop-up work and in suppression of spot fires discovered along roadsides.



Hose reel for Panama Pump outfit.

It was soon found that occasionally the unit had to be operated by a man working alone. Considerable difficulty was encountered by him in reeling up the hose without help. To solve this problem, a cheap but effective way was found to make the reel self-propelling. A second-hand Ford starter motor with a 2-inch V-pulley was installed on the hose reel frame; a V-belt connected the motor to an 18-inch V-pulley fastened to the reel; a starter switch mounted on the frame and connected with the motor by a piece of battery cable operated the motor; and current was supplied by the car battery through a battery cable. The drawing illustrates the method of installation.

The cost of materials was approximately as follows:

Starter motor (second hand)	$2.00
Starter switch	1.65
2-inch pulley	.50
18-inch pulley	3.00
V-belt	1.25
Battery cable (8 feet)	2.25
Total	$10.65

The mechanic's time involved about 4 man-hours and the helping mechanic an additional 4 man-hours.

POWER CHAIN SAW CARRIAGE

JOHN W. PARKER

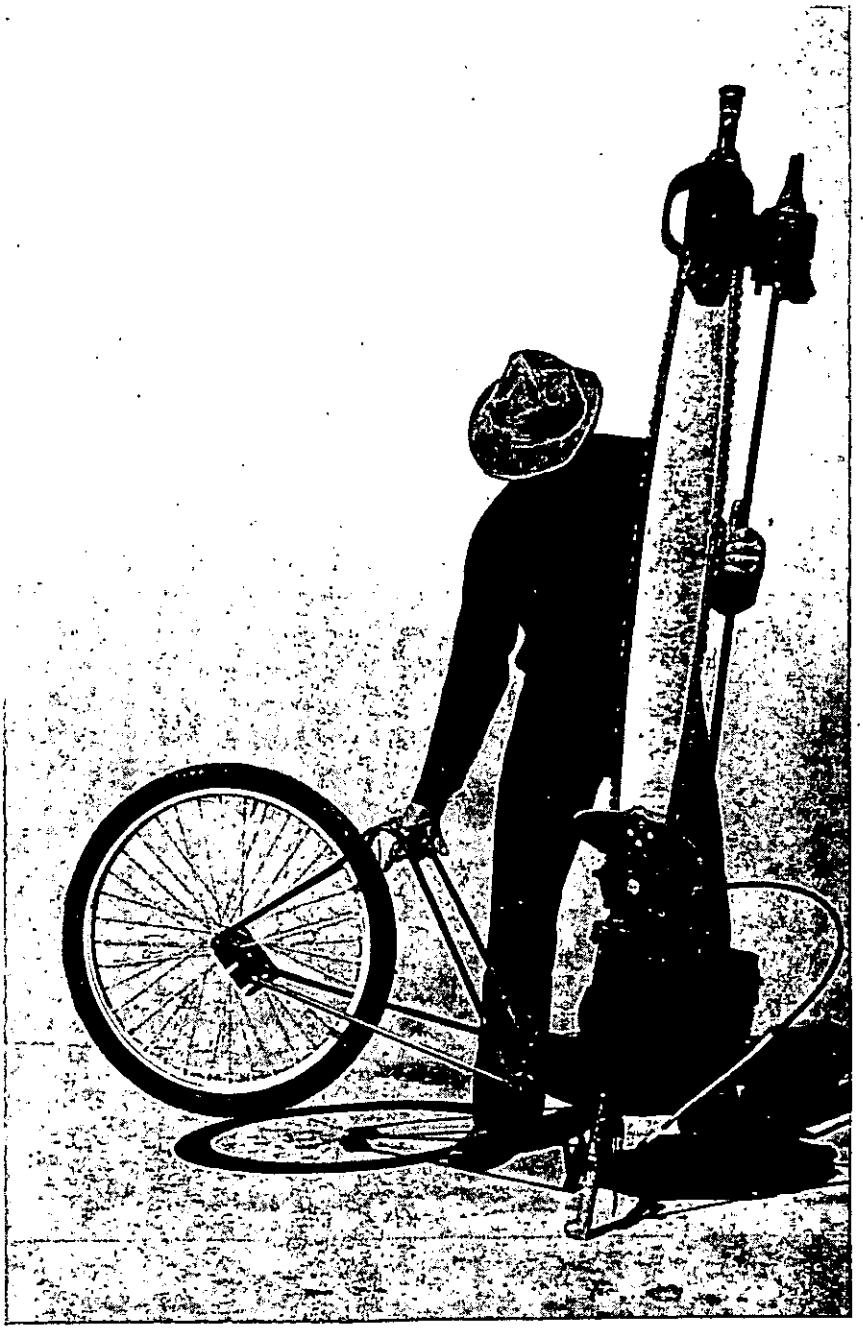
Forester (Fire Control), Boise National Forest, U. S. Forest Service

Private industry and the fire-protection organizations have used the gasoline-powered chain saws very successfully in many types of work. However, to make the use of this expensive saw worth while, production must be increased several times over and above what can be done with an ordinary crosscut saw. One drawback in the use of the power-chain saws is that they are heavy and hard to transport. To overcome the difficulty of transportation, the Boise Forest personnel has developed a light carriage which can be attached to and detached from the saw easily and which is capable of moving the saw over very rough terrain. One-half-inch airplane tubing is used for most of the frame, which makes it both sturdy and light. The total weight of the carriage is 13 pounds. The carriage was built for the Disston power chain saw, but can be adapted easily to any other similar make.

The carriage can be attached to the saw or detached from it in 15 seconds or less because of simple construction. There are no nuts or bolts to be removed and nothing to be lost or misplaced. The rear part of the saw is attached to the carriage by two bolts that fit into two holes in the frame of the saw. These bolts are tapered so that they slip through the holes easily and are bent back so that the saw cannot become detached while the front catch is in place. The front part of the saw is held in place by a hold-down clamp that fits into a ½-inch hole drilled in the abutment plate. The carriage is run on an ordinary 26-inch bicycle wheel.

Attaching the saw to or detaching it from the carriage can be done most quickly by one man as outlined in the following steps:

1. The power saw is placed on the ground.
2. The operator, using his right hand, takes hold of the front part of the carriage just to the right of the hold-down clamp.
3. With his left hand, he takes hold of the saw at some convenient point approximately in the center of the guide rail, and tilts the saw back on its handles till it is in a nearly vertical position.
4. While holding the saw in a vertical position, the two bolts in the rear part of the carriage frame are put through the rear holes in the motor frame.
5. The saw is now tilted forward until its weight is resting partly on its handles and partly on the wheel. The saw will remain in this position with only slight steadying by the operator.

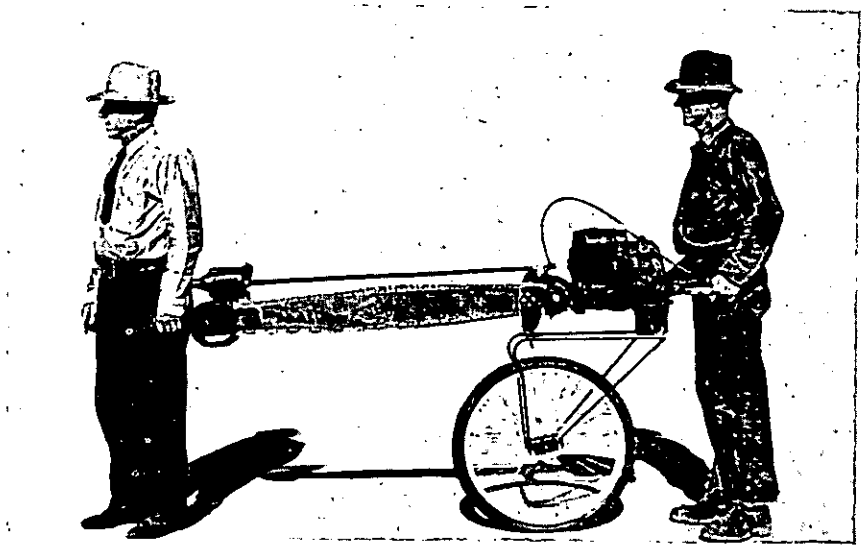


Mounting Disston power chain saw on carriage. One man can mount saw on carriage or dismount it in 15 seconds.

6. The hold-down clamp can now be engaged with the abutment plate with one hand.

7. The operator now grabs the handles of the saw and raises them to a convenient height, and the saw can be pushed wherever it is to be used.

8. To detach the saw from the carriage the process is reversed.



Disston power saw mounted on carriage. Unit can be moved by one or two men.

The saw can be moved by one or two men depending upon the terrain to be traversed. One man holds the rear handles and the other holds the tail stock handle.

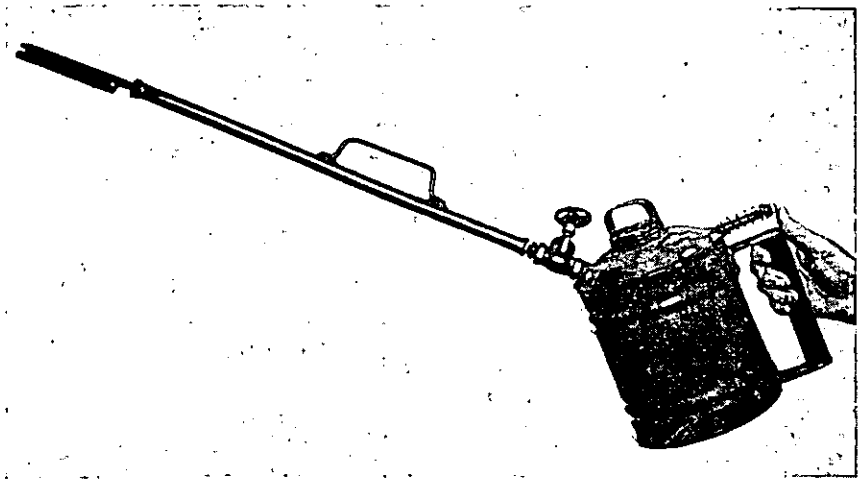
The power saw carriage can be constructed in nearly any shop by a competent mechanic. The cost of the unit is approximately $32 where one or two units are made.

THE FLORIDA DRIP TORCH

JOHN W. SQUIRES

Forest Supervisor, Florida National Forests, U. S. Forest Service

One of the most worth while developments that has come from the prescribed burning program in Florida has been a fast backfiring torch. Various flame throwers, propane torches, railroad fusees, and rakes had been tested previously. All of them had some weakness; they were either too burdensome to carry, too slow to do the job, or they didn't last long enough. Three years ago most of the backfiring



The Florida drip torch.

was being done with an asphalt rake. When the Chief approved the large scale prescribed-burning program, it was apparent that the speed of firing would have to be increased in order to burn the necessary acreage on the few days during the winter months suitable for such burning. To burn 1,500 to 2,000 acres per day, it would be necessary to string from 40 to 50 miles of line.

The idea of the drip torch doubtless originated with the pressure backfiring torch which was first used on the Mathis 2-disk fire-line plow. With this torch attached on the back of the plow, it was possible to plow a line and backfire at the same time. The torch consisted of a 10- or 15-gallon gasoline tank equipped to be put under pressure. The nozzle of the feed line was placed just above a wick which was ignited, and the gasoline was thrown by pressure across the burning wick and over the plowed line. Some of the plows on

the Florida National Forests still use this pressure torch. Under good conditions and with a supporting crew, it has been possible to plow 3 or 4 miles of line an hour and backfire it at the same time.

Members of the Osceola Ranger District and the Southern Forest Experiment Station at Olustee built and tested several backfiring torches in the fall of 1943. The model in use at the present time was made of a gallon kerosene can with a spout about 24 inches long, usually constructed from the inner barrel of a back-pack pump or of copper tubing. The end of the spout was filled with a rope or cloth wick just tight enough to allow the fuel to drip slowly when the spout was lowered. The principal difficulty was getting the proper type of fuel. The first tests were run with kerosene, with 1 quart of burnt motor oil added, and gave fairly good results. However, gasoline was tested with the motor oil mixture, and surprisingly the torch did not blow up. Safety experts maintain that such use of gasoline is very dangerous, so, even though the drip torch had been used for a month without an accident, it was decided that it must be tested. Two models were prepared and sent to the United States Bureau of Standards, where they were ignited and tested 50 times without accident. The Bureau, however, recommended the addition of a check valve air vent on the can and a loop in the spout as further safety precautions. One manufacturer has built a torch with similar specifications, but to date has been unable to produce more than a sample model. So far over 100 of the gallon-type drip torches have been built and used without an accident or an explosion, and 180,000 acres, which represents about 3,000 miles of back, flank, and head fire, have been prescribe-burned.

Naturally the Florida organization has learned a great deal about fire behavior and techniques for setting back, head, and flank fires. In the Florida forests most of the class C and larger fires are stopped with backfires. With the drip torch, backfiring can be done more efficiently and much faster. The speed of firing depends on the fuel being ignited.

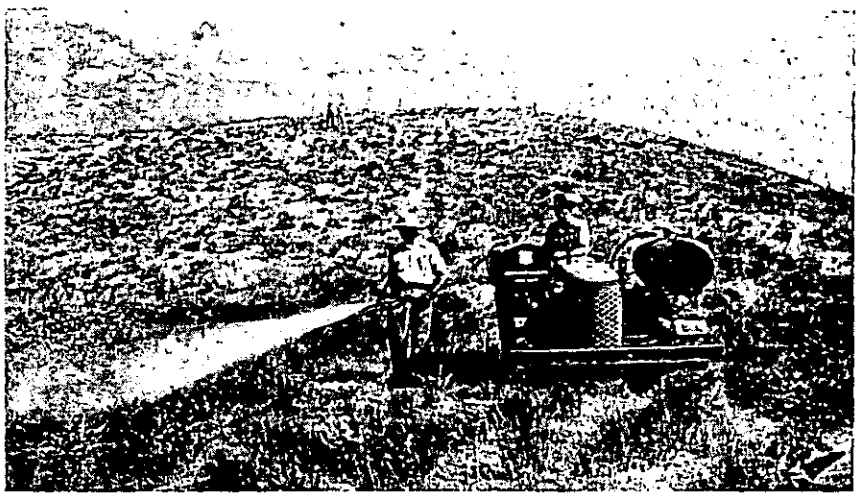
A man can string fire on the run at a rate of 5 to 7 miles an hour. The rate of firing on prescribe-burning averages from 2 to 3 miles per hour. By laying several parallel lines of fire in front of the head, the fire can be stopped with less chance of its jumping the backfire.

It has been found that with the drip torch, types that heretofore were almost impossible to ignite can be backfired. The scrub pine (pinus clausa) on the Ocala has always been difficult to backfire because there is very little fuel on the ground, but with the burning gasoline dripping on the light and scattered fuel it is possible to get a start in this type. All firemen in Florida now carry a drip torch in their pick-ups because they know that they are better able to handle a lot of grass fires by putting in a quick backfire.

FIGHTING FIRE WITH FOG

J. W. West, *Assistant Supervisor, and* Lowell J. Farmer, *Forester, Wasatch National Forest, U. S. Forest Service*

A brand new grass and brush fire-fighting machine evolved through the combination of a guayule project weed-spraying tractor and Region 5's mechanical adaptation of it, had its first work-outs this summer (1945) on the Wasatch National Forest (R–4) with some promis-



Trying out the fog nozzle on the watershed lands above Salt Lake City, Utah. The nozzleman and tractor operator easily work as a team on terrain like this.

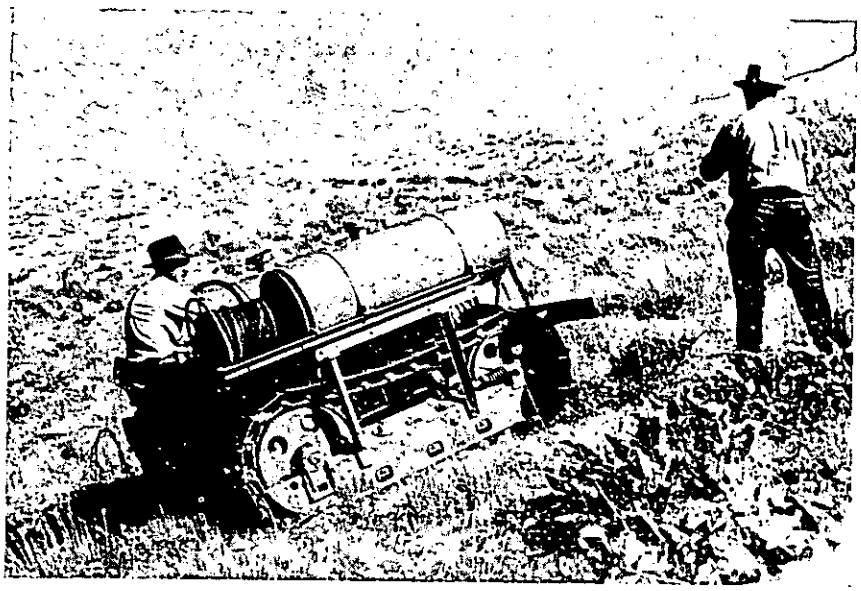
ing results. The machine consists of a model H. G. Cletrac crawler tractor with the gage widened from 42 to 55 inches by offsetting the left track 13 inches. It carries a Bean model Royal 10 pump of 17 g. p. m. capacity against a 600-pound pressure; two 53-gallon water tanks; 100 feet of ¾-inch high-pressure hose with Bean model 785 fog gun; 10 feet of 1-inch suction hose.

It is estimated that Region 4's initial expense of $1,897 for the fully-equipped machine ($500 labor for conversion, $76 for freight, $1,321 for the used tractor and pump) was saved by effective performance on one fire. Three or four thousand dollars more will be needed to correct mechanical limitations and provide suggested improvements.

Operating costs total about $4.20 per hour: Operation and repair, $1.00; depreciation, $0.50; operator, $1.10; nozzleman, $0.80; helper, $0.80.

Under favorable conditions, the fog knocked out grass and brush fire at the rate of one mile of line per hour. Were this rate to be cut in half for an over-all average it still would represent marked improvement and saving over hand fighting. The machine can lay down a creeping barrage of fog and control one-half mile of grass fire in 30 minutes with one tank (53 gallons) of water. And that (experienced fire fighters will tell you) is really snuffing out fire.

In its present stage of development, the unit can climb safely and perform on grass and light brush slopes of not more than 40 percent grade. Its water supply will provide fog for 40 minutes or a continuous stream of water for 17 minutes. Experience indicates that



The grass and brush watershed on slopes like this above Salt Lake City are easily negotiated by the unit.

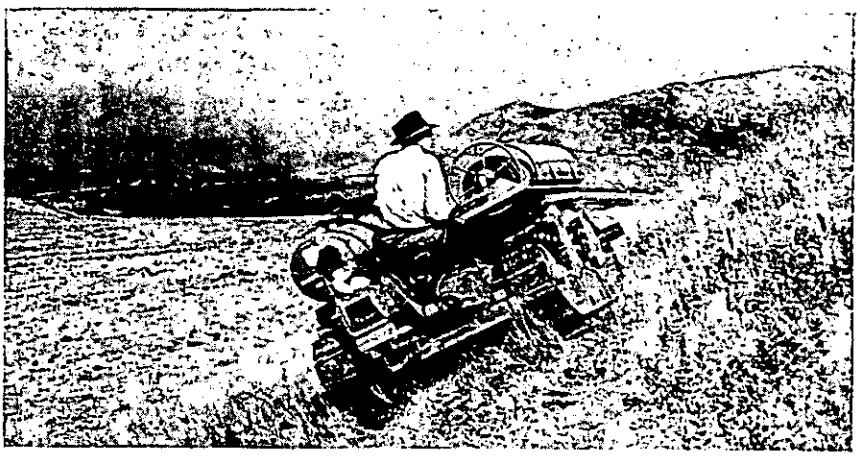
in either mop-up or suppression the greatest efficiency is obtained by using short bursts rather than steady streams of water or fog. This calls for a skilled and experienced nozzleman who knows whether stream, spray, or fog is needed, how much, and for how long. A fog knocks out running grass fires but a stream or spray is best for mop-up work in duff and litter.

The pump attachment operating by sprocket and chain drive from the power take-off will automatically maintain any pressure for which it is set. The high nozzle-operating pressure (most satisfactory at 600 pounds) makes it impossible for the operator to manipulate the flow, that is, the nozzle trigger must be either open fully or closed.

The ideal method of operation is for the outfit to make its way around the fire line snuffing out the fire as it goes. Three men (operator, nozzleman, and helper) all working together can perform

most efficiently with the helper keeping the necessary length of hose reeled off, seeing that it does not catch, and helping the driver spot the best line of travel. Both nozzleman and helper get the best results on foot where they are free from the uneven motion of the tractor.

For highest efficiency careful supervision and pretraining are required. On one fire the fire boss directed the machine to attack at a place that was, in the judgment of the operator, not traversible.



The fire fogger can operate safely up to a 40-percent grade on country like this

As a result the outfit became hopelessly stuck and remained useless for the remainder of the suppression work.

Performance tests conducted May 24 and 25, 1945, on the Los Padres National Forest and during July on the Wasatch National Forest showed that an improved machine should:

1. Be able to traverse slopes up to 50 percent through moderate brush.
2. Carry about 150 gallons of water or fuel in enlarged tanks.
3. Have increased gear ratios for more stability and speeds as low as 1 mile per hour forward and in reverse.
4. Have lengthened track assemblies with more of the load placed forward for better balance.
5. Have increased size of sprocket on power take-off to prevent overheating.
6. Have power-driven fuel pump to insure carburetor feed on steep slopes.
7. Have redesigned safety platform for nozzleman or riders.
8. Have rack for suction hose when not in use.

The test unit is considered, by those who have seen it in action, "a promising and effective fire fighter. With the added features shown by these tests to be needed, it can be made into a most efficient brush and grass fire-fighting machine.

THE FOGGER'S VITAL STATISTICS

Tractor:
- Model—HG42 Cletrac.
- Type—Track layer.
- Track width—10 inches.
- Ground contact—50 inches per track.
- Tread—55 inches (offset).
- Right half—21 inches.
- Left half—34 inches.
- Maximum pull—2,800 pounds.
- Weight—3,000 pounds.

Engine:
- Make—Hercules 3 x 4.
- Type—4-cylinder gasoline.
- Maximum horsepower—
  - 19.4 belt.
  - 14.0 drawbar.

Speeds:
- Forward—
  - First—2 miles per hour.
  - Second—3 miles per hour.
  - Third—5 miles per hour.
- Reverse—2.35 miles per hour.

Pump:
- Make—Bean.
- Model—Royal 10.
- Type—Triplex reciprocating.
- Discharge capacity—17 gallons per minute at 234 revolutions per minute.
- Working pressure—600 pounds per square inch.
- Weight—280 pounds.

Tanks:
- Type—Cylindrical with 2 baffle plates.
- Capacity—53 gallons.
- Number—2.
- Mounting—Directly above tracks.
- Dimensions—Diameter 20 inches, length 48 inches.

Accessories:
- One live hose reel with capacity for 100 feet of ¾-inch high-pressure hose.
- Ten feet of 1-inch suction hose complete with couplings and strainers.
- One model 785 Bean spray master fog gun with removable tips and a discharge capacity of from 6 to 15 gallons per minute.

Total weight:
- Tanks empty—4,700 pounds.
- Tanks filled—5,600 pounds.

NEW AX SHEATH

V. C. Hallin

District Ranger, Trinity National Forest, U. S. Forest Service

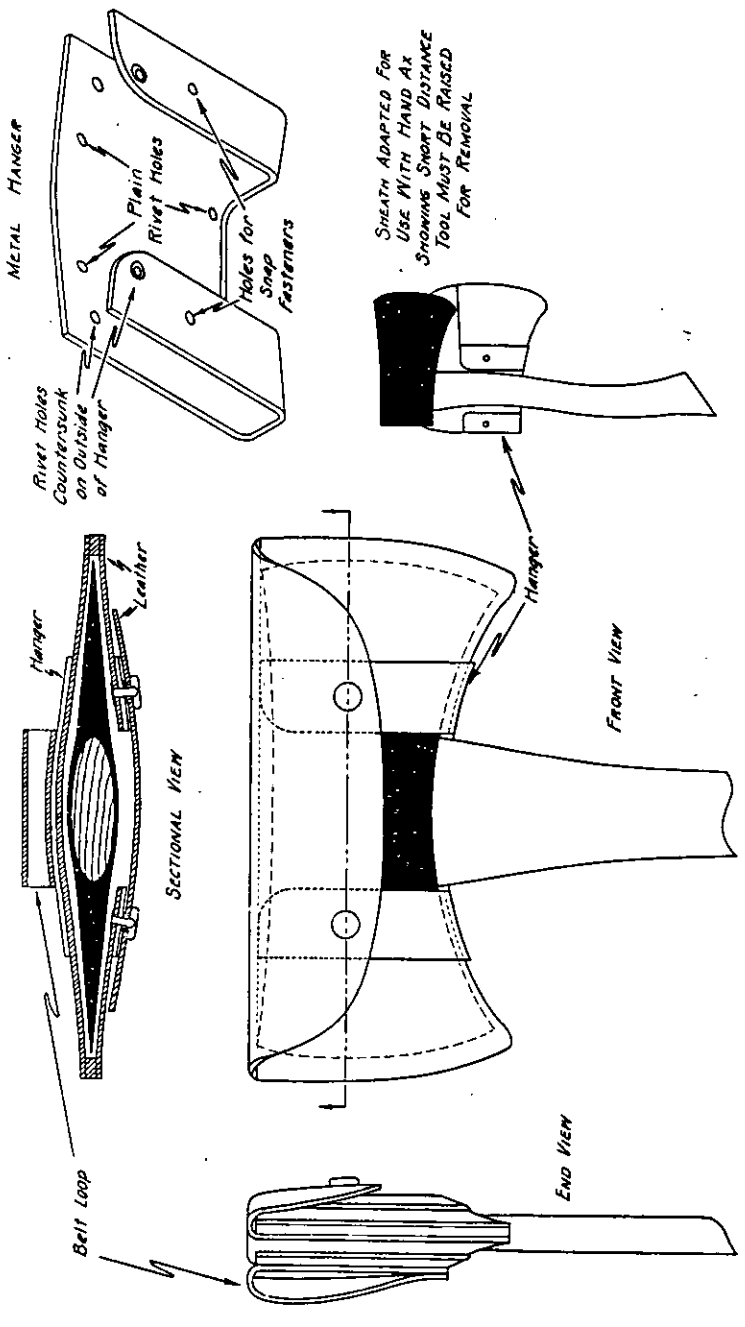
Inconvenience in sheathing and unsheathing has probably been the main obstacle to greater use of the conventional ax sheath. The same might be said about the standard carrying case for the light ax and hand ax. Since these are more readily carried at the belt than the regulation ax, the average woodsman will frequently continue the two-handed struggle every time he sheaths or unsheaths his hand ax, so that he may have his hands free for other duties while not engaged in chopping. In spite of its awkwardness, however, even the standard sheath has many advantages. It protects the tool from the elements, guards it against corrosion and abrasion, provides a convenient means of transportation, and is a safeguard against most accidents which might occur if cutting edges were exposed.

The writer, believing the woodsman should have better access to the tools which are his mainstay on the trail or fire line, in cruising timber, or on almost any other type of woods work, conceived the idea of a new type of sheath. This provided for encasing the central portion of a double-bitted sheath in a metal hanger, and cutting an opening through the outer side walls of both hanger and sheath to permit side entry of the ax handle. Two snap fasteners to lock the flap, and attachment of the belt loop to the back, complete the job. With the ax in sheath suspended from the belt, it is easy to grasp the flap and disengage both fasteners, grip the ax handle 6 to 8 inches below the bottom of the sheath, raise the ax until the head clears the hanger, and remove the tool with a sideward movement—all in a single-handed operation. Return of the ax to the case is almost as easy.

Advantages of Sheath

With any sheathed ax carried at the belt, there is always the possibility of taking a fall, catching the end of the handle in the ground or on some object, and then through failure of the flap fastening device, or because the latter is left unlocked, forcing the ax head from the sheath into a dangerous position. The Hallin holder will not entirely eliminate these dangers, but it does provide a greater opportunity for the ax to fall clear of the sheath.

The hanger type of carrier is not limited to the double-bitted ax. It may be adapted to the pole ax, hand ax, hatchet, marking ax, hammer, or almost any tool that can be suspended between two nails driven into a wall. The use of the hanger sheath for the marking hammer would do much to simplify the scaler's job. Similarly, the hanger sheath could be utilized to facilitate the work of the fire fighter, lineman, carpenter, timber cruiser, and many others.



DOUBLE-BITTED AX AND SHEATH

INFORMATION FOR CONTRIBUTORS

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

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

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

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

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

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

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