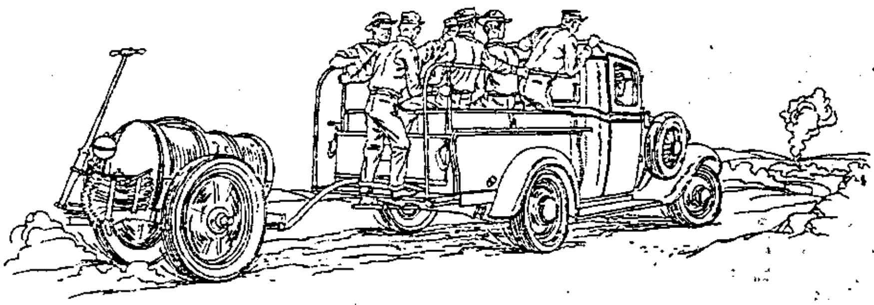
FIRE CONTROL NOTES

U.S. DEPARTMENT OF AGRICULTURE / FOREST SERVICE / APRIL 1967 / VOL. 28, NO. 2



FIRE CONTROL NOTES

A quarterly periodical devoted to forest fire control

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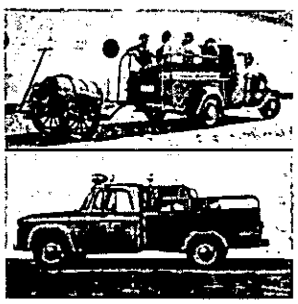

COVER—Small forest fire fighting tankers—early 1930's and 1967.
See related article on page 3.

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

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Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402, 20 cents a copy, or by subscription at the rate of 75 cents per year, domestic, or $1.00, foreign. Postage stamps will not be accepted in payment.

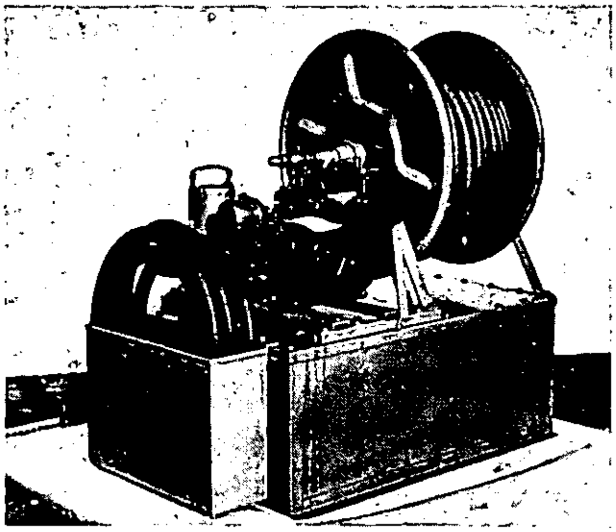

Figure 1.—The compact 50-gallon slip-on unit requires little space and is simple to operate.

The trend within Regions has been toward standardization of sizes, types of pumpers, and plumbing used on the forests. This trend has been adversely affected by the diversity of commercial pumping equipment and by various adaptations of this equipment in the field. In 1964, more than 12 tank sizes (40-200 gallon units) were reported. The greatest deviations in ground tanker usage were in nomenclature and in plumbing styles. The latter varied by forests, and some installations were haphazardly reducing the efficiency of the pumping unit.

The status of the Service-wide Slip-On Tanker Updating and Standardization Project represents a consolidation of many good tanker design features in use or commercially available. Several manufacturers have produced pumping equipment for more than 30 years. They have made many improvements in design. Most of their products have been developed in close coordination with experienced firefighters. For example, it has been decided to end mount the pump and motor at a level with the tank base on some tankers developed at the Center (fig. 2). Such mounting improves the driver's rear vision, lowers the center of gravity of the unit, and with centrifugal pumps, prevents draft problems. This mounting will be new to some areas. But a Mississippi pump company has manufactured end-mounted pumps for many years for use in Eastern States.

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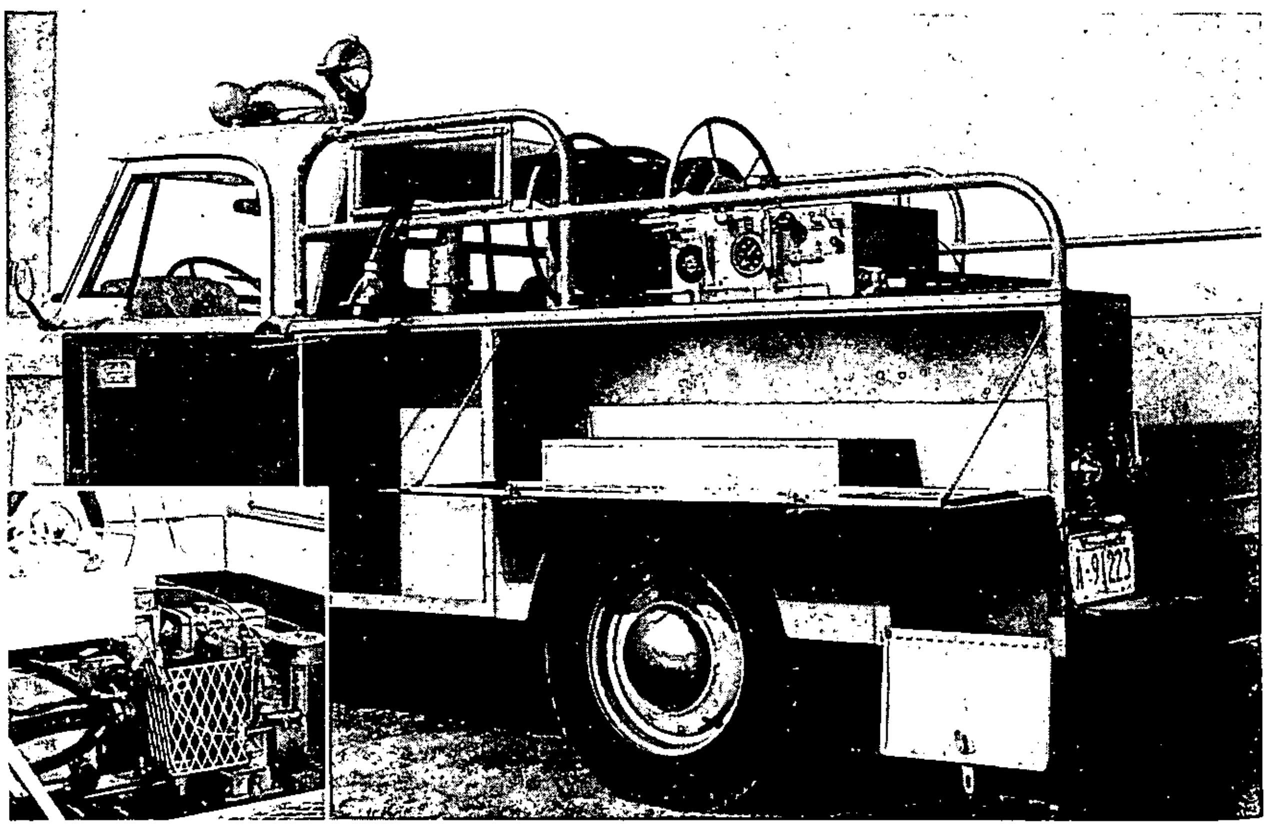

Figure 2.—This 75-gallon metal tank slip-on unit is mounted on a pickup with Low Silhouette body equipped with guardrails and hose reel guide. The inset shows end mounting of the pump. This series is also available in 125- and 200-gallon tank sizes.

LOMA RICA AIR-ATTACK BASE

ED CORPE, *Deputy Forest Supervisor*
Lolo National Forest[1]

The Loma Rica Airport, adjacent to the Tahoe National Forest in Nevada County, Calif., was first used for airtanker operations in 1957. However, due to its short runway, it was suitable only for single-engine aircraft such as the TBM.

A decision in 1964 by the Federal Aviation Agency and Nevada County to extend the runway to nearly 1 mile, permitting multiengine airtanker operations, and to construct taxiways, which would have crowded existing airtanker facilities, provided an opportunity for planning a new and expanded airtanker base.

FEDERAL-STATE COOPERATION

Both the Forest Service and the California Division of Forestry recognized the need for improved air-attack facilities in the area, and the planning and construction of the new base was a joint effort. The key factor in the final successful development of this modern installation was the full cooperation between the two agencies. The Forest Service purchased the site, provided limited financing, furnished the engineering design, and gave high priority to the acquisition of surplus equipment and material. Heavy equipment and conservation camp crew labor were furnished by the California Division of Forestry.

Improvements include three concrete slab fillports spaced for simultaneous loading of three B-17 airtankers; increased retardant mixing and storage capabilities, including electric pumps and a retardant recovery system; better facilities for the office, pilot's readyroom, shop, and warehouse (all in one building); and an improved taxi-traffic pattern (fig. 1).

CONSTRUCTION

Construction was carried out in two stages to permit the existing facilities to remain operational during the 1965 fire season. In the early spring of 1965, work started on the first phase. More than 14,000 yards of fill was placed and compacted on the sites for the aircraft area; the retardant mixing and storage delivery lines, water lines, communications lines, and electrical conduits were placed in the same ditch.

At the end of the fire season, the second stage of construction began. After final filling and grading, base rock was spread on the site, and mixers, tanks, and pumps were moved in from the old base. Pierced steelplate was installed as temporary paving until an asphaltic concrete mat could be laid.

THE NEW BASE

The base, which was operational during the 1966 season, has double batch mixers for use with a longterm retardant such as Firetrol; they have a capacity of 12,000 gallons per hour. A 200-gallon-per-minute gravity-feed mixer is used for a short-term retardant (such as Gelgard). Four storage tanks hold 62,000 gallons of slurry. The retardant is delivered to the fillports by three electric pumps (with 500-, 600-, and 800-gallon-per-minute capacities. (fig. 2) When the largest pump is used, an F7F airtanker can be loaded in less than 90 seconds. A

(Continued on page 15)

[1] Former Fire Control Officer, Tahoe National Forest.

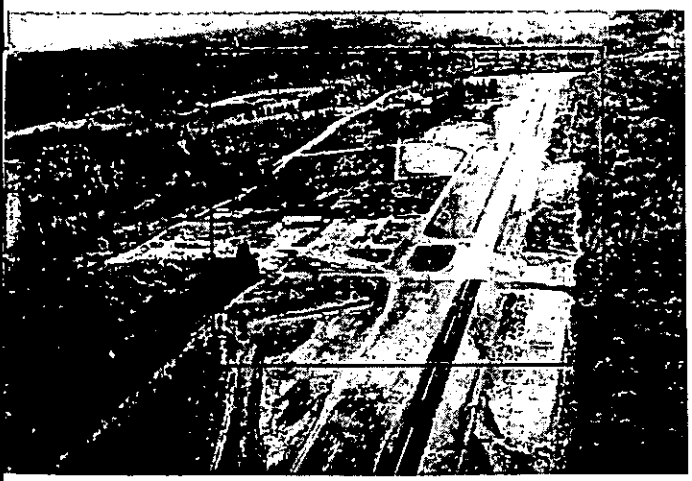

Figure 1.—Aerial view of Loma Rica air-attack base is shown.

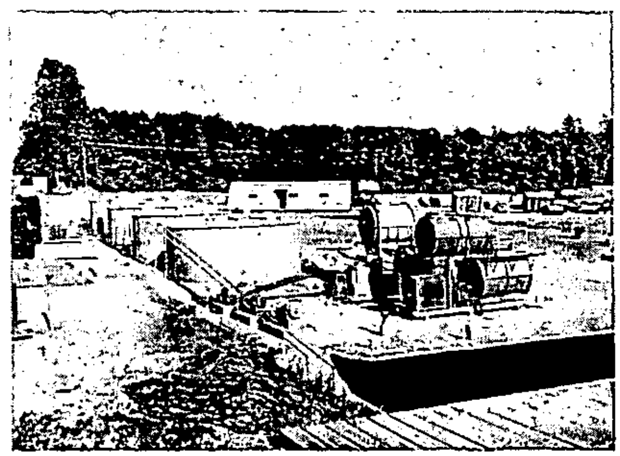

Figure 2.—View of batch mixers, storage tanks, and loading pumps during installation.

IMPORTANCE OF COORDINATED AIR-GROUND ATTACKS: A COMPARISON OF TWO FIRES

Paul G. Scowcroft, James L. Murphy, and Lynn R. Biddison [1, 2]

"Send in air tankers!" In recent years this order has become increasingly familiar when a forest fire started. But experienced firefighters know that the use of air tankers is expensive and that other fire control methods may cost less. Therefore, "Don't send in air tankers" has become an equally familiar order. When air tankers are sent, the most effective fire control action is a well-coordinated air-ground attack.

There are only a few well-documented cases of significant air-ground attacks. This article describes two fires that started 7 years apart on nearly the same location on the San Bernardino National Forest in southern California. The Monkey Fire of 1965 was potentially more dangerous than the Monkey Face Fire of 1958. But the 1965 fire was controlled at 35 acres in 3 hours, and the 1958 fire was controlled at 600 acres in 53½ hours.

This difference was due to several factors; these included greater use of air tankers, improved fire retardants and mixing-loading techniques, and better management of men and machines—especially in coordinating the air-ground attack. All other factors were important only because of this last factor. A study of the two fires suggests that a coordinated air-ground attack supported by properly trained hot shot crews can reduce the cost of putting out a forest fire.

Figure 1.—Head of the fire in 1965 was stopped by air attack at point X. Slopes were steep and heavy cover was ahead of the fire. Broken line indicates area of 1958 Monkey Face Fire; continuous line indicates area of 1965 Monkey Fire.

THE TWO FIRES

The Monkey Face Fire began at 12:30 p.m. on July 8, 1958, and the Monkey Fire started at 2:05 p.m. on August 6, 1965. The two fires started one-half mile apart on the same steep mountain slopes dominated by heavy chamise and chaparral (fig. 1). They occurred at about the same elevation, and the average slope of the fire areas was about the same.

A comparison of the two fires shows their similarity:

Item	Monkey Face Fire, 1958	Monkey Fire, 1965
Location	T. 1 S., R. 1 W., sec. 11	T. 1 S., R. 1 W., sec. 11
Elevation	4,600 feet	4,415 feet
Slope at origin	+45 percent	+4 percent
Average slope	+130 percent	+140 percent
Fuel type	Heavy chamise and chaparral.	Heavy chamise and chaparral.
Date and time of origin.	July 8, 1958 (12:30 p.m.)	Aug. 6, 1965 (2:05 p.m.)
Date and time of attack.	July 8, 1958 (12:43 p.m.)	Aug. 6, 1965 (2:17 p.m.)
Control time	53 hours, 31 minutes	2 hours, 55 minutes
Area at discovery	$<$1 acre	$<$1 acre
Fire load index	13 (high)	53 (extreme)
Rate of spread at discovery.	100 chains per hour	60 chains per hour
Character of fire	Spotting	Spotting

The 1965 Monkey Fire had at least four times the damage potential as the 1958 fire; this fact was indicated by the large difference in the fire load index.[3] One item—rate of fire spread at discovery

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[1] Snowcroft and Murphy are Research Foresters, Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif. Biddison, formerly a Research Forester at the Station, is a Fire Staff Officer, San Bernardino National Forest.

[2] The assistance of Everett Waterbury, Air Attack Specialist, San Bernardino National Forest, in gathering and preparing certain data and information for this article is gratefully acknowledged.

[3] A combination of the ignition and burning indexes in the California Wildland Fire Danger Rating System. The adjective rating for a fire load index of 53 is "extreme."

—seemed to contradict the existence of greater damage potential in 1965. The difference in rates was attributed to the slopes on which the fires were burning when discovered. As the 1965 fire approached the canyon walls, the slope more nearly equaled that encountered in 1958; thus, the difference due to effect of slope was diminished. Once the Monkey Fire reached the steep slopes, under the extreme burning conditions, the rate of fire spread probably exceeded that of the 1958 fire.

AIR ATTACK AND HOT-SHOT CREWS—THE ONE-TWO PUNCH

During both fires the ground crews had to scale steep (135 percent) slopes, and the fire head easily moved faster than the crews. Air tankers operated from Ryan Field, 26½ air miles away, were dispatched to both fires.

In 1958, air tankers dropped 5,000 gallons of borate on the fireline. Helicopters were not used to deliver retardant.

In 1965, air tankers made 16 runs, dropping more than 10,500 gallons of Firetrol and Phos-chek[4] on the flanks and head of the fire. Fire spread slowed or stopped on about 55 chains of the fire's perimeter. Two helicopters also made small drops on hot-spots. The checkline held for 2 hours, allowing the hot-shot crews to construct a final fireline around the fire's head. If the fire had not been checked, it probably would have moved into the San Gorgonio Wilderness area and burned about 1,500 acres of heavy fuels on steep terrain where there are no roads and few trails.

A comparison of the suppression forces used on the two fires follows:

Item	Monkey Face Fire, 1958	Monkey Fire, 1965
Initial-attack forces.	One man with handtools.	One man with handtools.
Followup forces	Hand crews, ground and air tankers.	Hand crews, ground and air tankers, and ground machines.
Maximum number of line workers.	516	215
Ground tanker line.	11 chains	105 chains[1]
Air tanker line	0 chains	55 chains
Ground machine line.	0 chains	5 chains

[1] The tanker line was increased almost tenfold in 1965 because the fire originated on the valley floor and more perimeter could easily be reached by hoselays. The 1958 fire began on the slopes of the mountain.

[4] Firetrol and Pros-chek are trade names for two long-term retardants based on di-ammonium phosphate and ammonium sulphate, respectively.

COSTS AND DAMAGES

Costs and damages were higher in 1958 than in 1965. Suppression costs were $160.000 in 1958 but only $19,160 in 1965. Estimated damages to resources amounted to $33,210 in 1958 and $300 in 1965. In addition, an indirect cost was incurred in 1958 when rain from a thunderstorm swept more than 40.000 cubic yards of debris from the burned area (fig. 2). About $100.000 was spent to remove the debris and clean up the area.

The erosion potential was far greater in 1965 because in November and December of that year, southern California had the heaviest rains of the past 25 years. Yet, no measurable erosion or production of debris resulted. And there was no damage which would have required expenditures for repair.

The savings in suppression costs and damages as a result of effective combined air-ground attack on the 1965 Monkey Fire totaled $274,520—even after adjustment for the declining value of the dollar.

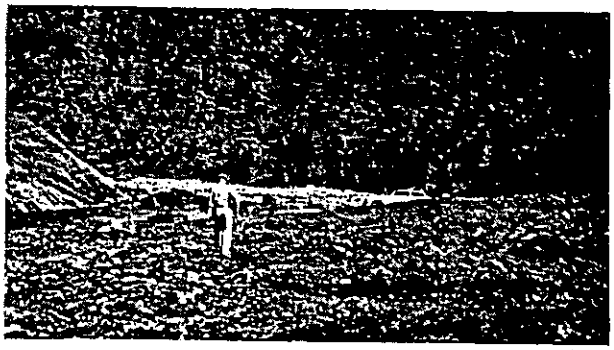

Figure 2.—Flood damage that originated from the 1958 Monkey Face Fire included more than 40,000 cubic yards of debris and buried portions of a State highway. The debris was washed from the burn (see below).

RAILROAD FIRES IN OREGON

JAMES B. CORLETT
Manager, Oregon Forest Protection Association

During much of American history, the great, puffing mainline steam locomotives pulled long lines of cars across the mountains, plateaus, and valleys of the West. In the woods, the old saddlebacks, Shay and Climax engines, pulled seemingly endless loads of logs to the tidewater mills, where lumber schooners paused in their voyages to the ports of the world.

However, these steam locomotives caused many fires along forest rights-of-way; therefore, many years ago the Oregon Legislature enacted laws regulating ashpans, screens, the water supply, and fire-fighting equipment. Some of these laws are still in force.

With the advent of diesel-burning locomotives, many protection people hoped that railroad fires would end. However, the new equipment became worn, lower grades of fuel were used, and equipment maintenance was not always optimum; therefore, railroad fires again became a major protection problem.

Railroad right-of-way fires on the forest protection districts of Oregon are increasing. For example, from 1954 through 1958, 3.2 percent of the yearly average of 828 man-caused fires on Oregon forests were railroad fires. However, for the 1,058 fires from 1959 through 1963, the percentage rose to 4.8. Incomplete statistics for 1964 and 1965 indicate that an even greater increase in the percentage of railroad fires can be expected for the 1964-68 period.

A recent report from 51 of the 402 rural and city fire departments of Oregon shows there have been 230 railroad right-of-way fires during 1965 in Oregon in nonforest protected areas. Of course, trains may not have caused all these fires. For example, some fires are caused by people throwing burning material from trains or smoking while walking along the tracks, or by youngsters playing with matches. However, most of these fires were caused by carbon sparks, brake shoes, hot boxes, fusees, dirty or faulty spark arresters, section gangs at work, etc.

Chip nets, right-of-way clearing, hotbox detectors, and lubricant and fuel oil research are being used by many railroads to reduce right-of-way fires. However, even greater emphasis on railroad fire prevention is needed. Protection organizations, legislators, and citizens unaware of these efforts have difficulty understanding why more has not been done.

Cooperation between the railroads and forest protection organizations in Oregon has been quite good. Reasonably good channels of communication have been established, and forest organizations have long had standard procedures for recovering costs incurred extinguishing railroad fires. The State forest laws contain provisions about the spread of fire to forests, and these laws have probably helped create the good working relationship between the railroads and forest protection agencies.

Railroad fires are especially difficult for small rural fire protection districts, many of which depend almost entirely on volunteer firemen. Because of inadequate finances, these men must often operate without adequate training, equipment, or protective devices. The recovery of railroad fire suppression costs by rural fire protection districts is complicated and confusing. In some of the newer rural fire districts, the volunteer firemen may not be fully informed about the Oregon fire laws. For example, railroad rights-of-way, rolling stock moving thereover, or improvements thereon are by law not included in rural fire protection districts unless the railroads consent to be included. However, the State Fire Marshal has authority to order the accumulation of any combustible material on any premises, including railroad rights-of-way, removed or the condition remedied. He also has authority to enforce such orders if necessary.

Some Oregon residents advocate the legislative approach to the problem of railroad fires. However, many have learned that legislation does not necessarily yield the most desirable or workable solutions to problems. It should be undertaken only after all possibilities for cooperative solutions have been exhausted.

In 1963, all fire organizations in Oregon—rural and city, private associations, State, and Federal—formed the informal Oregon Fire Action Council to solve fire problems through cooperative action. One major accomplishment of the Council has been to open channels of communication among all organizations concerned with fire prevention and control. All participants have learned that their problems are not unique and, through cooperative effort, solutions can frequently be developed. The Council believes that the railroads have a strong interest and stake in the prevention of railroad fires. Some make annual contributions to fire prevention programs. Others also contribute money, time, or training to

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A WEATHER BRIEFING BOARD FOR FIRE CONTROL

D. John Coparanis, *Fire Weather Meteorologist*
U.S. Weather Bureau
Portland, Oreg.

Regional Dispatcher: "There's a lightning fire out of control in southern Oregon on the Fremont. I'll need to draw on some men and equipment from up north. What does the weather look like for the next 2 or 3 days in Washington?" This type of question is often heard in the Portland Fire-Weather Office during an active fire season. The Portland Fire-Weather Office is unique because it is a Weather Bureau facility in the Division of Fire Control of a Forest Service Regional Office (R-6). Therefore, Fire Control personnel can easily "tap the weatherman" for information.

Besides issuing daily fire-weather forecasts, the fire-weather meteorologist at Portland provides twice-daily briefings on Regionwide (Washington and Oregon) weather. The Regional Dispatcher attends these briefings and uses information received for both planning and operations. Additional briefings are sometimes provided for other Forest Service officials.

Some of these briefings are very detailed because the weather patterns cause a variety of weather effects over the forecast area. The details are difficult to remember 5 minutes after the briefings, especially when it becomes necessary to apply thse details to each of the 19 National Forests in the Pacific Northwest Region.

Therefore, a visual display board for the weather elements important to Fire Control was installed (fig. 1). The board consists of five parts:

1. Surface and upper air weather maps
2. Fire-weather forecasts from the six Fire-Weather offices: Portland, Salem, Medford, and Pendleton (all in Oregon) and Olympia and Wenatchee (both in Washington)
3. Regional map showing rainfall
4. Teletype copy of satellite bulletin
5. Regional map depicting forecast weather elements for each National Forest

The surface and upper air weather maps are received over the facsimile machine ready for display.

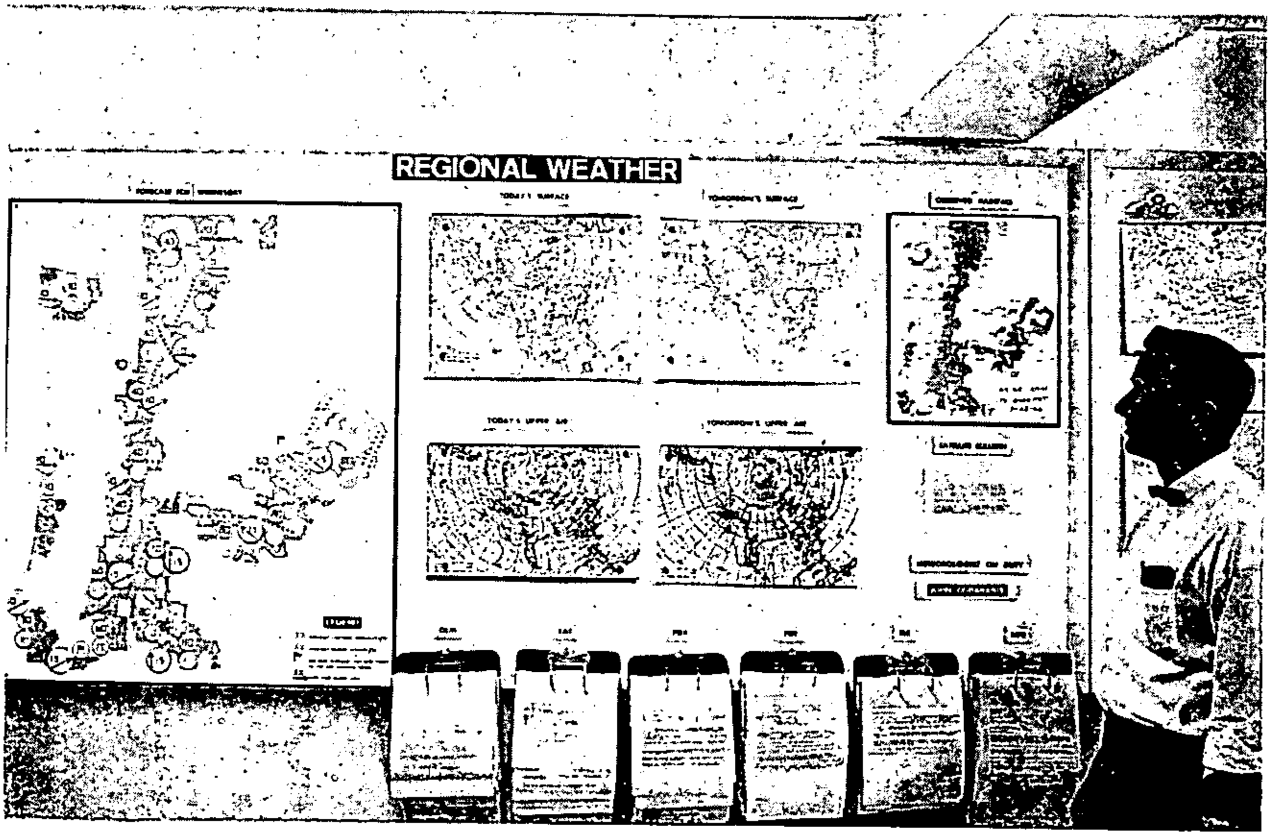

Figure 1.—This weather briefing board is at the Portland Fire-Weather Office.

These depict the weather patterns over much of the Northern Hemisphere both as they are observed "today" and predicted for "tomorrow." Use of these maps permits the three-dimensional characteristics of the atmosphere to be described.

Detailed fire-weather forecasts received at the Regional Office from the six Fire-Weather offices in the Pacific Northwest are posted on clipboards.

A small Forest Service Regional map is used to record rainfall. This information is important because it indicates the areas relieved from drought.

Environmental Science Services Administration satellite pictures of cloud cover over and adjacent to Oregon and Washington are received daily at the Weather Bureau Office in Seattle, Wash. These pictures are interpreted by meteorologists at Seattle and transmitted in plain language messages over weather teletype. This information is often included in the fire-weather forecasts to place emphasis on certain weather predictions.

A large Forest Service Regional map depicts forecast elements for each National Forest; color coded numbers are used (fig. 2). The forecast lightning probability is shown as a red number and the forecast minimum humidity as a green number. In addition, the forecast speed and direction of winds over ridges is shown for larger areas. All this information is extracted from the detailed fire-weather forecast. If a "Red Flag" forecast—one which calls attention to a weather condition of unusual importance—is issued by a Fire-Weather Office, a red flag tag is placed at the Fire-Weather Office's location. The metal rim tags with numbers are hung on permanent small pins (two per Forest). These tags are easily changed so the board can be kept current. The wind tags can be hung on pins or temporarily taped anywhere on the base map to show the general windflow over a large area.

Figure 2 graphically shows a special fire-weather condition. As can be seen by the wind direction arrows posted, southerly winds aloft are entering southern Oregon. In the summer in the Pacific Northwest, these winds have a high correlation with widespread thunderstorm activity. Consequently, a high probability of lightning (60-80 percent) is forecast for most Oregon Forests. Minimum humidities predicted for this same area are 10-20 percent. These conditions have prompted two Fire-Weather Offices, Medford and Pendleton, to issue "Red Flag"

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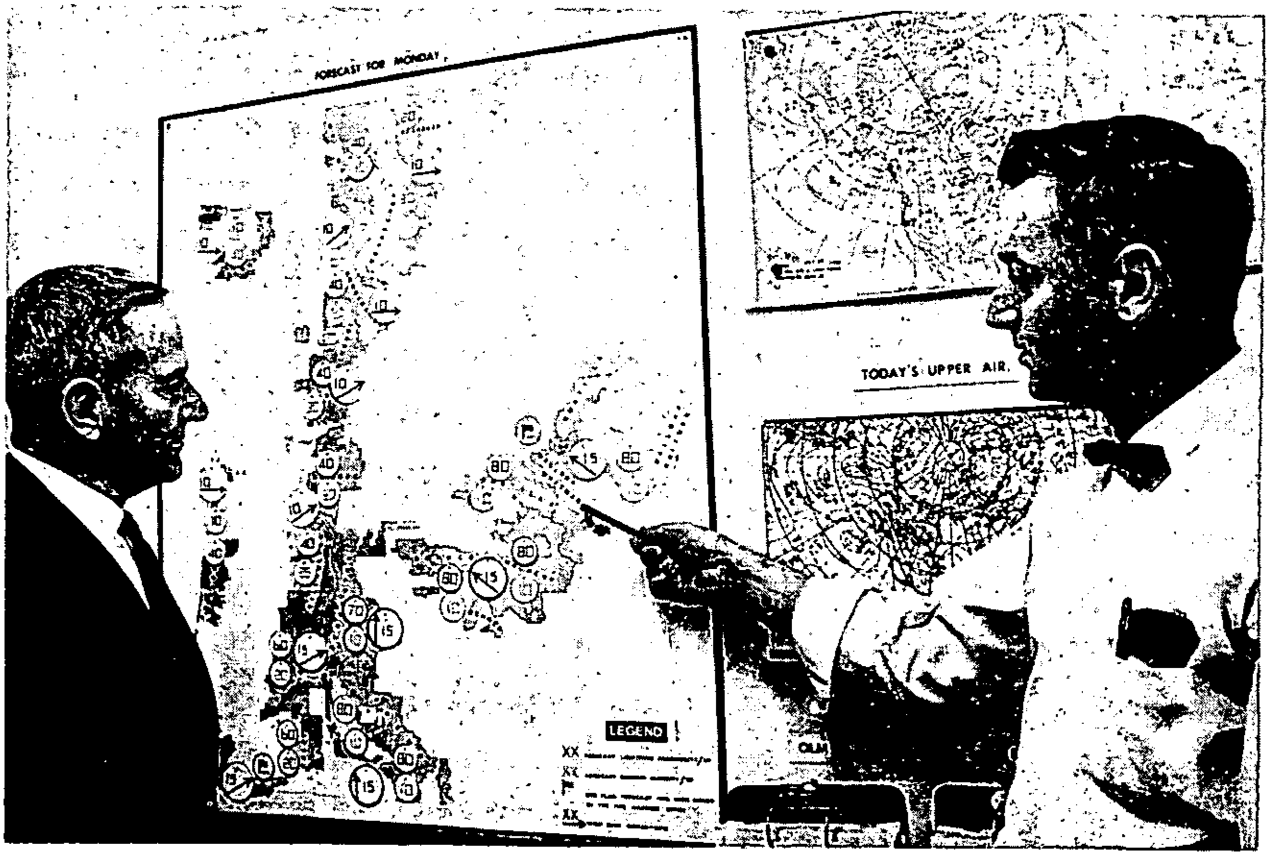

Figure 2.—This Regional map visually depicts important forecast fire-weather elements.

A MODERN DISTRICT WAREHOUSE

Donald H. Marriott
Fire Control Officer, Trabuco District
Cleveland National Forest[1]

The fire warehouse on the Orleans District, Six Rivers National Forest was recently remodeled to provide a modern facility for the efficient handling and storage of equipment and supplies.

Major changes in the structure included removal of all windows to permit better utilization of wall space and to reduce maintenance and cleaning costs. Also, all partitions, closets, and panels not needed for building support were removed. These changes have facilitated movement of supplies in and out of the building, and permit a quick inventory of all fire equipment. The original two 32-inch doors and one heavy sliding door were replaced by three 10-foot aluminum overhead doors. Incandescent light fixtures were replaced by daylight-type fluorescent lighting. Porch lighting was similarly improved, and night loading is now very safe.

Shelf storage 8 feet high and 2½ to 3 feet deep has been constructed along the entire 46-foot rear wall. Metal lettering strips like those used in supermarkets are fixed onto each shelf, and the name and inventory count of items on each section are shown. A rolling ladder provides quick access to the upper shelves (fig. 1). Handtools are stored in two racks similar to those shown in an earlier Fire Control Notes article.[2]

Open bins on both sides of the stairway hold smokechaser equipment where it is readily accessible and easily inspected. The space under the stairs was closed off and is used for storing brooms, mops, and other maintenance supplies. A screened, rodent proof room was built to provide storage space for radios, batteries, blankets, and fusees. A separate lock is used on this room.

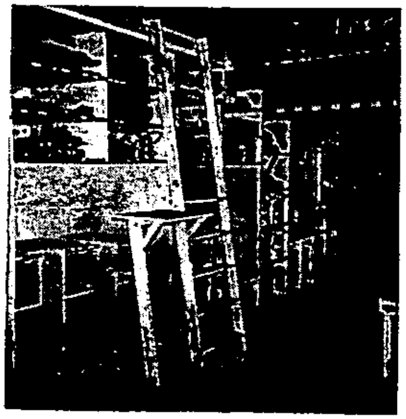

Figure 1.—This ladder provides safe access to items stored on upper shelves. The attached table holds material while a man climbs down.

A hardboard flooring surface permits easy movement of the individual castered pallets on which all floor cache boxes are stored, and the entire fire equipment inventory can be moved onto trucks by one person. Also, all equipment on the ground floor can be quickly wheeled back behind the stairway to make a 30- by 26-foot area available for meetings and training sessions.

The second floor is used primarily to store project tools and equipment. Bulky or heavy items are moved to and from this area by a stair lift. This consists of a small 110-volt electric winch which pulls a wheeled platform on rails up the stairway (fig. 2). This type of lift was selected instead of a cage elevator to save floor space on both levels. The winch housing is built against the rafters, where lack of headroom prohibited storage.

The docking facilities are able to accommodate five vehicles at one time. Either side or rear loading is possible at two of the three bays. A removable chain railing guards all dock edges.

Savings in man-hours spent handling equipment and supplies during the next 5 years are expected to pay for the remodeling of the warehouse. Also, since inspection of tools and supplies can be more easily carried out because they are readily visible, maintenance of the fire cache will be improved. A third and important benefit of the facilities is safety—equipment is handled by units, and lifting and carrying is not needed.

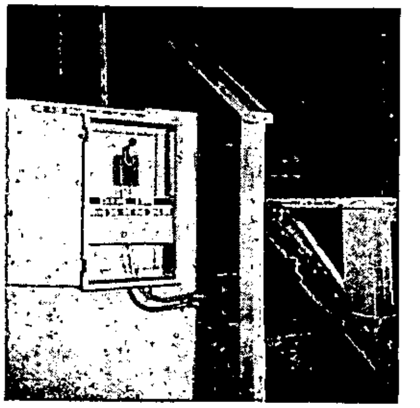

Figure 2.—View of stair lift and control panel is shown. When not in use, the lift platform is pulled up out of the way under winch at head of stairs, and rails fold up along far edge of stairway.

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[1] Former Fire Control Officer, Orleans District, Six Rivers National Forest.

[2] Region 4, Forest Service, USDA. Care and storage of handtools. Fire Control Notes, vol. 24, No. 4, October 1963, pp. 99-100, illus.

MARKING PERMANENT HELISPOTS WITH FIBERGLAS PANELS

P. A. Theisen, *Forester*
Siskiyou National Forest

An inexpensive, prefabricated marking system which requires little maintenance was developed on the Siskiyou National Forest in southwest Oregon. The markers identify permanent helispots developed for multiple use management (fig. 1.).

The helispot marker is made from yellow corrugated Fiberglas panels, which are readily available from local building suppliers. Other high-visibility colors are also available.

Panels are cut to specifications (fig. 2) and drilled for 3/8- by 10-inch spikes driven into the ground to anchor the panels. Rubber or plastic washers can be used between the spike head and the Fiberglas to prevent the panel from being pushed past the spike head if frost heaving is likely to occur. Identification letters and numbers are painted on the base panel with black polyurethane paint. The sides of four triangles can be cut from a 10-foot-long panel of Fiberglas 26 inches wide. Three bases can be cut from a 12-foot by 26-inch panel.

The Fiberglas and 14 spikes needed for one helispot marker cost approximately $3.27.

Figure 1.—A completed marker for a permanent helispot is shown.

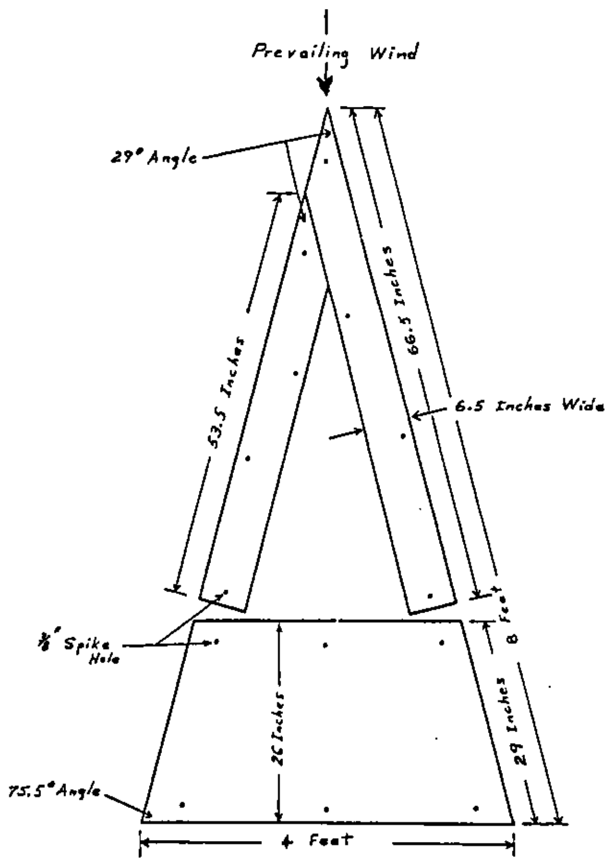

Figure 2.—Diagram of Fiberglas panel used to mark permanent helispots.

THE RELATION OF SPREAD INDEX TO FIRE BUSINESS IN CONNECTICUT

JOHN J. KEETCH, *Forester*
Southeastern Forest Experiment Station

The State of Connecticut has used fire danger[1] measurements to plan their fire prevention and other fire control activities for more than 25 years. In 1964, the spread tables of the National Fire Danger Rating System were adopted; they replaced the type 8 Burning Index meter used since 1954. This article examines the relation between spread index and two easily measured aspects of fire business—number of fires and number of acres burned by size class. Connecticut was selected for this study because it has a heavy fire load and an active fire control organization. Also, the State started using the spread index a few months earlier than other States.

The Connecticut State Park and Forest Commission is responsible for protecting about 2 million acres of forest and woodland from fire. This task is particularly difficult because the State is fourth in population density (517 people per square mile according to the 1960 census). The cause of fire is related to this high population density. During the 1954-63 period, 98.2 percent of the State's fires were man-caused.

In 1964, 943 fires burned 3,566.6 acres. The percentage of man-caused fires was the average 98.2, but the total number and acres burned were 50 percent greater than the average for the previous 10 years. This relatively high rate of fire activity provides a good basis for evaluation of the effectiveness of spread index and its relation to fire business.

By definition, the spread index is a number (on a 100-point scale) indicating the relative, not actual, rate of forward movement of surface fires. The spread index value is an abstract number until it is related to the local conditions of a fire protection unit. But reliable data on free spread of wildfire are seldom recorded. Therefore, fire business items related to spread that *are* recorded must be considered; these include the distribution of fires and acres burned by size class. This information is immediately useful in interpreting and applying the spread index in local fire control preparedness planning.

Fire data for this study were obtained from code sheets prepared by the State for the annual Forest Fire and Forest Fire Danger report. Daily spread index values were read from fire danger records prepared at four fire danger stations operated by the State and at one station operated by the U.S. Weather Bureau.

Fires may occur on almost any day in the year, but they usually are not distributed evenly. Fires are concentrated in the spring and fall because burning conditions are more severe and because fire-starting agents are more active.

In 1964, more than 90 percent of the fires and 94 percent of the burned acreage occurred during the spring (March-May) and fall (September-November). This distribution of fires and acres suggested that a two-part grouping of the data might be most useful to identify the general relation of spread index to fire business. Accordingly, in tables 1 and 2, spring and fall fires are combined to represent the fire season; summer and winter totals indicate off-season trends. The ranges of spread index in units of five provide a finer breakdown than is normally used, but the added detail improves clarity.

Since the two seasons were equal in number of days, factors other than time must account for the unequal fire experience between them. The factors contributing to the difference are numerous, but they may be broadly grouped into those bringing changes in: (1) Relative risk, (2) ignition potential, (3) rate of spread, and (4) effectiveness of control effort. The spread index obviously provides only a portion of the information needed to equate fire danger and fire business in the State. Nevertheless, until more refined tools are available, such as an index related to ignition, the spread index may be used as a general guide.

It is clear that fires did not have an equal opportunity to start and spread in the fire season and in the off season (table 1). In the off season there were only 11 days of spread index 15 or more; there were 94 such days in the fire season. Also, in the lowest four spread index ranges, where both seasons were represented, average fire incidence per day in the fire season was two or three times the rate in the off season. This comparison indicates that the activity of fire-starting agents is greater in the fire season by a ratio of 2 or 3 to 1. In turn, this ratio suggests that a given level of preparedness is needed at a lower predicted spread condition in the fire season than out of season.

TABLE 1.—*Number of days, fires by size class, and average fires per day, by spread index range, Connecticut, 1964*

FIRE SEASON

Spread index	Total days	Total fires by size class			Average per day (all fires)
		0-9.9 acres	10.0-99.9 acres	100+ acres	
0-4	28	6	0	0	0.2
5-9	18	24	1	0	1.4
10-14	43	111	9	0	2.8
15-19	36	190	8	0	5.5
20-24	34	211	22	1	6.9
25-29	15	145	13	1	10.6
30+	9	95	11	3	12.1
All	183	782	64	5	4.7

OFF SEASON

Spread index	Total days	0-9.9 acres	10.0-99.9 acres	100+ acres	Average per day (all fires)
0-4	98	13	0	0	.1
5-9	48	26	0	0	.5
10-14	26	22	4	0	1.0
15+	11	27	0	0	2.5
All...............	183	88	4	0	.5

The distribution of fires by size class in table 1 reflects the potential for fires to spread faster as the spread index increased. The bulk of the fires were held below 10 acres regardless of spread index, but holding down the size apparently became more difficult as the index increased. During the fire season, about one fire of more than 10 acres occurred every 4 or 5 days in index range 10-14, about 1 per day in index range 25-29, and more than 1 per day at index 30+. Fires of 100 acres or more appear at index 20-24, but most (3 of 5) occurred during the 9 days when the spread was 30+.

Presumably, fire preparedness was increased as the potential for fires to spread increased because most fires were contained at a small acreage. The largest fire reported was 250 acres. But evidence that the task became more difficult as spread index rose is indicated in table 2. Below index 20, only 43 percent of the acres burned were by fires of more than 10 acres in final size. Above index 20, this percentage rose to 68. In the top spread range, the larger fires accounted for 78 percent of the total burn. Certainly factors other than those indicated by spread index were involved; such factors included topography, elapsed time, and local fuel concentrations. But the record does indicate a strong trend for fires to become harder to handle as the index climbs.

The consistent increase in average fire activity with each rise in the level of spread index reflects the greater opportunity for fires both to start and to spread as the index rises. Average occurrence in the fire season climbed gradually from about 1 fire every 5 days in the lowest spread range to about 12 fires per day in the top spread range (table 1). A similar increasing trend in the area burned on an average day is indicated in table 2.

In summary, while the figures in the tables are averages, the continuous uptrend in the average daily fire business indicates a potential change in average fire load that should be extremely useful to fire officials in interpreting and applying predicted spread index in preparedness planning. The values reported here apply only in Connecticut, but similar trends may be expected in other areas where man-caused fires are of major concern.

TABLE 2.—*Number of days, acres burned by size class, and average acres burned per day, by spread index range, Connecticut, 1964*

Spread index	Total days	Burned area by size class			Average acres burned per day (all fires)
		0-9.9 acres	10.0-99.9 acres	100 acres+	
FIRE SEASON					
0-4	28	4.2	.0	0	0.2
5-9	18	31.7	18.0	0	2.8
10-14	43	180.6	183.0	0	8.5
15-19	36	273.6	170.0	0	12.3
20-24	34	374.1	550.0	120.0	30.9
25-29	15	227.1	227.0	100.0	36.9
30+	9	194.7	227.0	466.0	98.6
All	183	1,286.0	1,380.0	686.0	18.3
OFF SEASON					
0-4	98	16.4	0	0	0.2
5-9	48	33.5	0	0	.7
10-14	26	30.2	80.0	0	4.2
15+	11	54.5	0	0	5.0
All	183	134.6	80 0	0	1.2

CHILDREN WITH MATCHES

NATIONAL WILDLIFE FEDERATION CONSERVATION NEWS

Berkeley, Calif.—Would you believe 92 percent of the forest fires started by children playing with matches are set by boys (not girls)? It's true, at least in the Angeles National Forest where the University of Southern California made a study of that problem for the U.S. Forest Service. Would you believe that 5-7-year-olds set most of the fires studied? That's true, too. Dr. William S. Folkman, a sociologist doing research on forest fire prevention, said the Angeles National Forest was chosen for the study because it is representative of a problem now developing all over the United States—increased residential development and higher human populations at the fringe of wildlands.

***Air-Attack Base*—Continued from page 5**

4,000-square-foot quonset building is at the corner of the aircraft area; it provides space for the office, readyroom, shop, and warehouse. Two F7F airtankers under Forest Service contract are stationed at the base. At least one B-17 is expected to be available in the future.

The Loma Rica base is operated jointly by the California Division of Forestry and the Tahoe National Forest. Work schedules and safety and operating plans are developed and approved by both agencies, and operational costs are shared.

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Slip-On Forest Fire Tanker—Continued from page 4

However, Service-wide demonstrations are needed to inform fire control personnel of end mounting and other new or changed equipment designs. The San Dimas Equipment Development Center has selected titles for slip-on tankers for Service-wide use. The Center has distributed much needed information about new equipment and become recognized as a source of technical assistance.

Region 5 has sponsored and financed the development of prototype tankers incorporating many design features which have Service-wide application. The R-5 ground tanker committee has kept experienced firemen informed of slip-on tanker development at the Center. Regions 6 and 9 have also been leaders in the use of water equipment in forest fire control. The design of slip-on tankers has been influenced by every Forest Service Region.

Two primary advantages will result from the Slip-On Tanker Updating Standardization Project. One will be completion of Service-wide specifications for popular-size tanker outfits, and another will be development of standard Forest Service plumbing drawings for qualified pumpers. Purchasers will be able to select and match tanks, pumpers, and reel or tray and have them assembled by qualified contractors.

Slip-on tanker purchases planned during the 1964-69 period include 260 small (50-80 gallon), 165 medium (100-250 gallon), and 40 large (over 250-gallon) units (fig. 3). The 50-, 75-, 125-, and 200-gallon tankers are expected to be the most popular in the future.

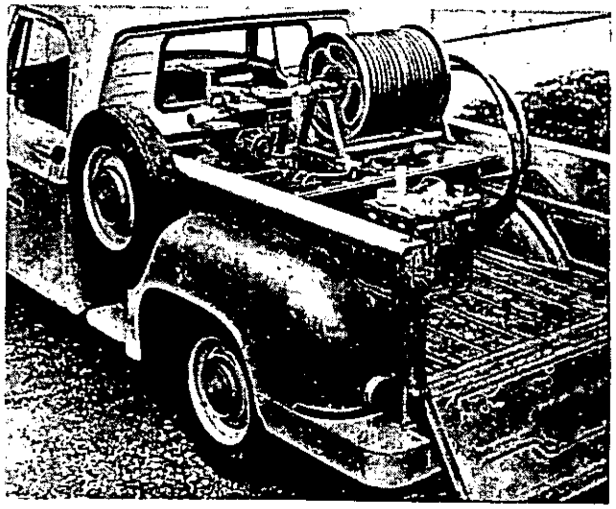

Figure 3.—An 80-gallon slip-on unit with a Fiberglas tank is shown. These tanks are lighter than metal, and allow more water to be carried.

Weather-Briefing—Continued from page 10

forecasts. Lower probabilities of lightning, and generally higher humidities, are predicted for the other Forests in the region.

The Division of Fire Control is very enthusiastic about the weather briefing board. During the fire season, it is posted twice a day to coincide with the twice-daily fire-weather forecasts. The day of the week for which the forecast is valid is posted above the large Forest Service base map.

Railroad Fires—Continued from page 8

other prevention programs, both in and out of the railroad organization.

However, the problem of railroad fires needs additional serious study, and the Council has invited representatives of the Oregon railroads to join in its deliberations and efforts. The protection organizations are confident that, by working together, the many problems connected with railroad fires can be better clarified. Cooperative solutions can be developed which will benefit all parties concerned.