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FIRE CONTROL NOTES

A PERIODICAL DEVOTED TO THE TECHNIQUE OF FOREST FIRE CONTROL

FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE

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

Volume 17 Number 2

FIRE CONTROL NOTES

A Quarterly Periodical Devoted to the

TECHNIQUE OF FOREST FIRE CONTROL

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

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Forest Service, Washington, D. C.

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THE IMPORTANCE OF DESIGN IN EQUIPMENT DEVELOPMENT

STEVEN SUCH

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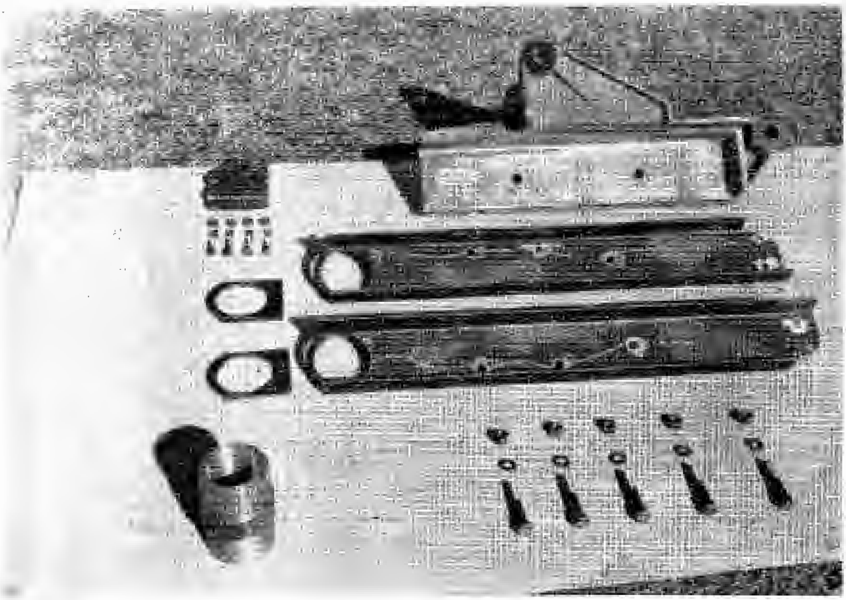
The current trend toward complete mechanization has had its influence in forest fire protection as much as it has in any other field. Prior to the time of heavy-equipment application to forest fire control, only limited usage could be made of anything more effective than the simple agricultural tools. In less than a generation we have moved from shovel to bulldozer, and from buckets to large tankers and high-pressure pumps.

Behind the scenes of this mass movement to powerful machinery is the field of equipment development, made up of research, design, and manufacturing, and of continual testing and improvement. All of these are vital factors in any successful development program, and not the least of these is good design. Simply and concisely, the determinants of design are *cost, appearance, safety,* and *efficiency.* Rarely, if ever, is any one of these items the sole determinant of design. The careful designer will use all of them in guiding his work, with emphasis on an individual item if there is special need.

Americans today are becoming exceedingly cost conscious. This fact is particularly conspicuous in modern industry where the byword is "cost reduction." Automation is nothing more than rapid production with an eye to lower costs. New methods and modern contrivances for manufacturing are directly intended to mass-produce at a minimum cash outlay. The effect of cost consciousness on the designer too is marked. He can never forget that anything he designs must match the consumer's ability to pay; if it does not, it will receive a minimum of use. Such thinking is at times hard to justify from a designer's viewpoint, particularly when he is concerned with quality. Nevertheless, every effort must be made to produce the best possible product within the allowable cost bounds.

Appearance, although normally nonfunctional, must influence all design work. A general rule of thumb that any design that looks good is good, is a risky premise on which to work. A safer premise is that an attractive appearance is the basis on which a majority of manufactured articles are sold. The consumer is entitled to expect smooth and harmonious lines blended into a finished product. However, in designing it remains a matter of common sense not to give a disproportionate amount of time to appearance at the sacrifice of the other three items of cost, safety, and efficiency.

What can be said about safety that has not been said before? Seemingly very little. Absolutely nothing is more deserving of attention than any condition that can threaten the life or health of a man. Utmost care and thought must therefore be given at all times to operational safety factors and devices. It is the designer's duty and moral obligation to keep safety foremost and always in mind. Socially speaking, safety in design is probably the most important single item to be considered.



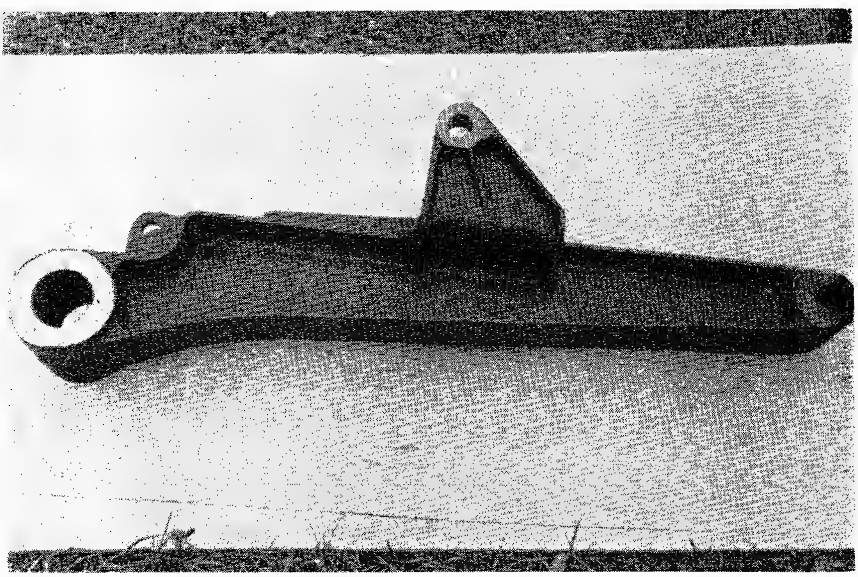


FIGURE 1.—*Top,* These 34 parts were formerly required to make up the beam portion of a hydraulically controlled plow. *Bottom,* This one casting replaces all of the parts in the top photograph. Note smooth lines and minimum machining.

The word "efficiency" in connection with the design of any one unit, as used here, covers (1) operational efficiency, (2) ease of manufacturing, and (3) the combination of multiple functions. Operational efficiency of equipment, for example, is measured by the effort required of the equipment and the excellence of execution of the given job. It is noteworthy that more often than not a high efficiency rating accompanies simplicity of design. The reason for this is beyond the scope of this article.

Where parts are to be manufactured in large quantities, ease of manufacturing is of prime importance. Very often the availability of a machine is determined by its design. In contrast with operational efficiency, ease of manufacturing is measured in terms of hours and dollars. It is therefore extremely important to keep production methods and costs as a control medium in design.

Finally, an alert designer will be constantly aware of the possibilities of combining functions and parts in the interest of efficiency. This means that sound, basic design principles of the most stable nature will be applied, not tinker's innovations.

A practical example of the application of the four determinants of design is found in a casting recently developed in Michigan for use in the production of hydraulically controlled plows. Thirty-four separate pieces were formerly required to do the job the one casting now does alone (fig. 1). The raw-material cost of the casting is approximately four-fifths of the previous cost. Manufacturing time has been reduced to about one-half. Operating efficiency has been increased at least 25 percent. All of the safety devices of the former assembly have been kept. Appearance has been noticeably improved, and at least six separate functions are being performed by the lone casting.

Design has become a significant part of equipment programs in the field of forest fire control because men with much experience in that field know that the best guarantee of strong equipment is good initial design. It is no accident that the steady decrease in acreage lost per fire in Michigan is accompanied by a better and better fleet of fire fighting equipment. Good initial design of equipment will continue to be sought after as one means of fast and effctive control of forest fires.

MARKINGS FOR IDENTIFICATION OF FIRE CONTROL VEHICLES FROM THE AIR

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The rapidly increasing use of aircraft in fire control work during recent years has raised many problems for forestry officials in supervisory positions. The Wyoming Forest District, one of the twenty administrative units of the Pennsylvania Department of Forests and Waters, has been no exception. This district includes, as about one-third of its area, the northern edge of the anthracite coal fields. Once the forest fire hot spot of the State, the section has cooled decidedly over the past 15 years, but because of its high percentage of forested lands, numerous hazards, and flashy fuel types, it is still a fire problem of considerable scope. As a result, the use of aircraft in the district has become greater with each passing year. Planes are used for detection, scouting, and directing ground crews.

One of the major problems has been the identification, by pilot or observer, of ground vehicles of the supervisory personnel of the district. These include those of foresters, fire inspectors, forest rangers, and smokechaser teams. Until the past year, practically all department vehicles were standard model trucks and cars. In the main, fire inspectors and smokechaser teams are assigned ½- and ¾-ton pickup trucks. Rangers use ½-ton pickups and have light dump trucks which are occasionally used for fire work. The foresters drive pickups and standard sedans. Unless these vehicles have special fire fighting rigs such as tanks, live reels, or side racks holding spray tanks, they are indistinguishable from hundreds of similar vehicles when viewed from the air. Many of the fire wardens dispatched to a fire also drive light trucks. Before air to ground radio became available, message-drop tubes were often thrown to crew units distant from the supervisory officer on the fire. In many cases the information dropped never reached the fire boss.

Inspector Robert J. Startzel at the Hazleton Station decided to mark each of his trucks with two white bars about 8 inches wide and at least 4 feet long, parrallel to each other and extending from the front to rear of the truck cab (fig. 1). This marking was soon applied to the fire vehicles throughout the district. When the two aircraft in use were equipped with radios capable of communicating with the tower sets, vehicle mobile units and field portables, the problem of identifying supervisory vehicles became twofold. The primary concern was for the pilot to recognize radio-equipped vehicles to which direct voice contact could be established. The secondary concern was recognition of super-

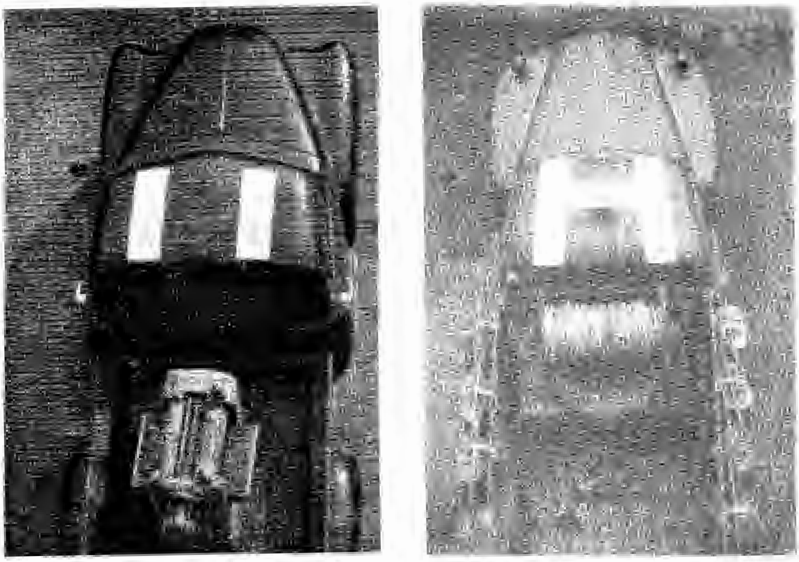

FIGURE 1.—*Left,* Marking originally used to identify all district vehicles. Now used to identify all vehicles not equipped with shortwave radio. *Right,* All district vehicles marked with the crossbar are equipped with shortwave radio.

visory vehicles, not radio equipped, that required use of drop tubes. This latter class was significant in that the vehicles of park and forest rangers in the north end of the district were not radio equipped.

To solve this problem, all radio-equipped vehicles now have a white crossbar painted between the parrallel bars, forming a large H on top of the cab. All district vehicles regardless of their primary work function now carry either the parallel bars or the large H.

During the severe summer fire seasons of 1954 and 1955 and the hazardous spring season of 1955, the pilots of the aircraft and the forestry personnel who often flew with them to direct control activities found these simple markings made it possible for them to identify key vehicles rapidly. It also speeded establishment of contact with the ground forces, especially by radio.

INTEGRATING PREVENTION INTO FIRE CONTROL PLANNING

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Historically, fire control planning has been concerned primarily with the job of detecting and extinguishing fires; little effort has been made to coordinate fire prevention activities with suppression and presuppression work. But history is a record of change, and now is the time to progress beyond the familiar pattern of fire control planning.

Why has prevention been subordinated or excluded from planning? One reason is that early fire control objectives were based upon the need to keep the total area burned annually within a given percentage of the total area protected. Show and Kotok established that the total area burned was closely correlated with the percentage of fires exceeding 10 acres.[2] They concluded that the area burned could be reduced to an acceptable amount only by prompt, effective attack aimed at extinguishing all fires in their initial stages. Under this concept the number of fire starts is relatively unimportant—providing all fires are quickly controlled.

There are two additional reasons why prevention has not been emphasized in fire control planning. First, planning is usually done on actuarial principles, that is, plans are based on past experience. Therefore, in the planning analyses fire occurrence is considered either as a constant or as having a constant trend.[3] Second, transportation and communication facilities have only recently advanced to the point where prevention and suppression activities could reasonably be undertaken by the same personnel during the fire season.

As a consequence, neither the official Forest Service fire control policy (10:00 a. m. control) nor Hornby's principles of fire control planning[4] provide for fire prevention as an intergrated fire control activity.

This is not to say that fire prevention has been ignored or ineffective. Far from it; the national forests in California had 19 percent less man-caused fires per thousand acres in 1950-54 than

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[1]Maintained at Berkeley, Calif., by the Forest Service, U. S. Department of Agriculture, in cooperation with the University of California.

[2]SHOW, S. B., and KOTOK, E. I. THE DETERMINATION OF HOUR CONTROL FOR ADEQUATE FIRE PROTECTION IN THE MAJOR COVER TYPES OF THE CALIFORNIA PINE REGION. U. S. Dept. Agr. Tech. Bul. 209, 46 pp., illus. 1930.

[3]HORNBY, L. G. FIRE CONTROL PLANNING IN THE NORTHERN ROCKY MOUNTAIN REGION. North. Rocky Mtn. Forest and Range Expt. Sta. Prog. Rpt. 1, 179 pp., illus. 1936.

[4]GISBORNE, H. T. HORNBY'S PRINCIPLES OF FIRE CONTROL PLANNING. Jour. Forestry 37: 292-296. 1939.

in 1930-34, and 25 percent less area was burned per thousand acres by man-caused fires. During the same period, the *percentage* of fires exceeding 10 acres remained almost constant, while the *number* of class C fires decreased in approximately the same proportion as the total number of fires. From the record it would appear that fire prevention efforts have been as effective as, if not more effective than, increased presuppression and suppression activities in reducing the area burned on the national forests of California. A stepped-up prevention program which would bring about a further decrease in the number of fires started should pay off equally well in reducing the area burned and the consequent damage to natural resources.

To insure that fire prevention plays its most productive role, it must be integrated with the planning and normal operation of the fire control team. Stathem[5] summed up this reasoning in the phrase "A prefire rather than a presuppression organization." To meet the requirements of a prefire organization, principles of fire control planning should be developed which recognize the prevention job as being basic to successful fire control. Once fire control agencies are organized for prevention, they may achieve results far beyond any established goals.

Organizing around fire prevention need not sacrifice the tested standards of initial attack time and strength. Actually some California national forests as well as some State and county units are modifying fire control plans to emphasize prevention. Many standby fire suppression crews have been converted to roving prevention-firemen. They perform prevention jobs while maintaining the same, or improved, standards of initial attack. However, to achieve maximum benefits from a reorganized fire control plan, it will be necessary to do more than merely shift functional responsibilities from one group to another. If fire prevention is to be integrated into fire control planning, a major reevaluation of planning methods is needed.

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[5] STATHEM, P. A "PREFIRE" RATHER THAN A "PRESUPPRESSION" ORGANIZATION. Fire Control Notes 15 (4): 32-37. 1954.

DEN TREE FIRES IN MISSOURI

OSAL B. CAPPS
District Forester, Missouri Conservation Commission

Smoking squirrels out of den trees is an old Ozark custom. Hill people, in general, see nothing wrong with this method of securing "meat for the table" until they realize that more than a game law violation is involved. Some see fire burn their property; others see damage to someone else's property; some realize that many squirrels either burn in the blazing dens or escape. Then, too, the news spreads quickly when someone is convicted in court for causing forest fires.

Fires caused by burning den trees occur more often near population centers and are usually started by urban people who were born and reared in rural areas. Methods used to smoke out squirrels include placing a lighted railroad fusee, igniting dry leaves, or setting fire to gasoline in the base of a hollow tree.

Den tree fires are more of a nuisance to fire control personnel from an acreage-burned viewpoint than a serious threat. They are potentially dangerous, however, in areas where tower coverage is poor. State organizations interested in hunter-landowner relationships also must consider the "No Hunting" signs that are often posted on private land after this type of fire has aroused the anger of the owner toward hunters in general.

The Gasconade District of the Forestry Division, Missouri Conservation Commission, comprises almost 2 million acres of privately owned land. The district is about 66 percent forested and Fort Leonard Wood, Rolla, and several smaller towns are included in its area. Hunters from St. Louis, Jefferson City, and, to a much lesser degree, Kansas City, hunt in the district. Den tree fires were given little consideration until the serious drought years of 1952, 1953, and 1954. In normal years many squirrels are probably smoked out of den trees without the trees catching fire, or, if the trees do burn, without starting active forest fires. During the drought years practically all smoking-out attempts started fires in den trees and these in turn caused active forest fires.

Plans were made in late 1952 to investigate all fires more thoroughly in an effort to separate den tree fires from debris burning fires. Fire prevention activities, including law enforcement, were pointed at den tree fires. Newspaper and radio publicity was given to the number of fires, the damage caused, and the penalties imposed on persons convicted in court for starting such fires. An "Every Sportsman a Fire-fighter" project was highly publicized on a statewide basis to educate the sportsman and to enlist his help in preventing and suppressing fires.

On the Gasconade District in 1953, 70 fires (17 percent of all fires) were definitely started by hunters attempting to smoke squirrels out of den trees. These fires burned 457 acres and accounted for 9.5 percent of all acreage burned. All of these fires were investigated to determine where and how they started. Evidence, such as empty shotgun shells near the den tree, was sought and an attempt was made to find out who was hunting in the area at the time each fire started. Such facts are difficult to determine because several hours may elapse before the smoldering fire builds up enough to be seen from towers or aircraft.

As a result seven individuals were convicted in court for "molesting den trees by setting fire to trees" or for "negligently causing woods to burn by setting fire to trees." No cases were lost and fines ranged from $1 and court costs to $50 and costs. Court costs ran about $8.50. The average fine was $25.14. Where evidence insufficient to prosecute was secured, persons who had started fires were contacted and warned.

On the Gasconade District in 1954, 47 fires that started from burning den trees burned 155 acres. This was 16 percent of all fires and 4.9 percent of all acreage burned. Six persons were convicted in court for this type of fire law violation. The average fine was $8.50 and court costs again ran about $8.50 per conviction. One man was sentenced to 90 days in jail with the sentence stayed upon good behavior.

Den tree fires will continue to be a nuisance on this district for several years and will be particularly troublesome in drought years. This type of fire will have to be expected and planned for at all times but should decrease in occurrence in proportion to the effort spent in educational activities and law enforcement. Rural residents who smoke out squirrels in normal years become aware of the danger in drought years and are much more careful than their city cousins who frequently have no interest other than "getting meat for the table" or a lot of squirrels to brag about when they go home.

The city man who wants a place to hunt in the future should take heed—the farmer will not tolerate hunters who damage his property. The small fire, while only a nuisance to fire control personnel, may damage some of the best trees a farmer owns. Good sized trees are frequently killed by late spring and early fall fires. Many city hunters will get blamed and penalized for every indifferent hunter who smokes out a squirrel.

SPRAY PLANE CHECKS FIRE

DIVISION OF FIRE CONTROL
Region 6, U. S. Forest Service

Through the years there have been a number of methods in which aircraft have water bombed or applied water to ground fires. As far as we know, the spray-plane method of application described herein is a "first." Two important points need to be understood in connection with the operation: pilot skill, and fuel type.

Pilot Skill:—Crop-dusting spray pilots are skilled pilots. They know their planes and just what can be expected of them. They understand low-level downdrafts and cross winds. No other pilot spends as many hours flying at treetop heights.

Fuel Type:—The fuel type in this fire was cheatgrass. Cheatgrass is a thin-stemmed annual now present to a greater or lesser extent in all the western States except Arizona and New Mexico. When cured, cheatgrass is very flammable. Cheatgrass fires, especially when occurring on steep slopes or when wind-driven, are fast spreading. Except for their fast spread, they are are easy to control. Because of the fineness of the stems, cheatgrass fires frequently go out by themselves in the late evening with the rising of the humidity. A very minor amount of spray will bring about control.

During the winter of 1955 the Wenatchee Air Service of Wenatchee, Wash., suggested to Fire Staff Officer Bob Beeman, of the Wenatchee National Forest, that a spray plane might be of value in checking the head of a fast-spreading fire in fuels of the type described. Beeman agreed.

On July 23 a dry lightning storm set a fire on the slope of the Wenatchee River canyon near Cashmere, Wash. The fuel type was cheatgrass with scattered sagebrush. The slope was steep. Here was the chance for a test. The plane used was a 135 horsepower super cub equipped with a 100-gallon tank. The plane had, mounted on its wings, twelve ¼-inch nozzles, six to the side, with a shut-off control from the cockpit.

Pilot Carey made 2 runs across the head of the fire, flying with 1 wingtip at the fire's edge, 10 to 15 feet above the ground. The water spread was approximately 33 feet, the air resistance breaking the water up into a fine spray. The runs were made on the uphill side of the fire on the wind side. Water discharge was 1-½ gallons per second and the plane carried enough water for 60 seconds of application. One-quarter mile of fire front was covered at each run.

This trial proved the effectiveness of the spray in checking the head of the fire and gave the ground crew time to control the flanks without difficulty. The fire was controlled at 55 acres.

In reporting this experiment, Supervisor Blair said, "On being advised by Pilot Carey that he had flown 10 to 15 feet above the ground, I felt that this distance was too close for safety and the possibilities of the plane being caught in a downdraft were too great to permit a continuation of this practice. I am, however, of the opinion that the use of spray planes on fires of certain types has possibilities but more thought needs to be put into the risks involved."

The Wenatchee Air Service suggests that a plane of greater horsepower be used, such as a Stearman with a 450-hp. engine and 150-gallon water tank.

Supervisor Blair commented, "On this particular trial no wetting agent was used in the water."

It is not likely that a wetting agent would have been of any advantage. There is no evidence that it increases the extinguishing power of water on an extremely fine fuel such as cheatgrass. Its value is in deep-seated fuels where penetration is desirable. However, a fire retardant certainly may have possibilities in fires such as this. When a retardant is used it makes no difference if the fine spray does dry out in advance of the fire reaching the line. The salt deposits on the fine fuel will still stop the fire under many situations.

A progress report on Operation Firestop states: "It appears that chemical fire lines may be put in by aerial application." A Sikorsky S-55 helicopter, as was used in the California tests, might well be the answer. Military cooperation, however, would be necessary.

In the fall of 1947 a wild burning prairie fire spread over 380,000 acres of South Dakota farm and grass lands in 2 days. Losses were in excess of 2 million dollars. Much of the fire line, in situations like this, could be "laid down" from the air. Canvas tanks, similar to Harodikes, could be made to fit into the larger helicopters; spray booms could be attached. This would cost money, but so does a 2-million-dollar fire.

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CANVAS WATER SHOW

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A big tank truck, with water capacity of 500 to 1,500 gallons or even more, roaring up to a hard-to-hold sector of fireline causes the pulse to quicken. It's like the feeling, akin to jubilation, experienced by an exhausted, hard-pressed line construction crew when a snorting bulldozer comes crashing through the brush. This is help, real help, when it's needed most.

However, big tankers cost money. There are never enough of them. Frequently there aren't any at all. Does this mean that the use of water on holding, control, and mopup need be abandoned? Not necessarily. Here is an opportunity to put in a canvas "show"—provided you have the gear, and you can buy a lot of gear for the cost of one 300-gallon tanker.

Admittedly, tankers give you a maneuverability not possible with a canvas show. In that respect they are superior. If you can't have the best you will have to settle for less, and second best might very well be a canvas show—unless, of course, the available water is such that you can operate a pumper or gravity show. A canvas show need not necessarily be fixed or immobile, as we shall see.

In addition to hose (which might be considered canvas), nozzles, and in many situations pumps, a canvas show layout may utilize any or all of the following gear: Storage tank, gravity sock, relay tank, transporting tanks. This equipment permits a wide range of combinations in various water show setups.

Storage tank.—A new production item manufactured by a Midwest firm is a lightweight, folding, portable 1,000-gallon tank (figs. 1 and 2). The tank is 8 feet 3 inches square and 30 inches

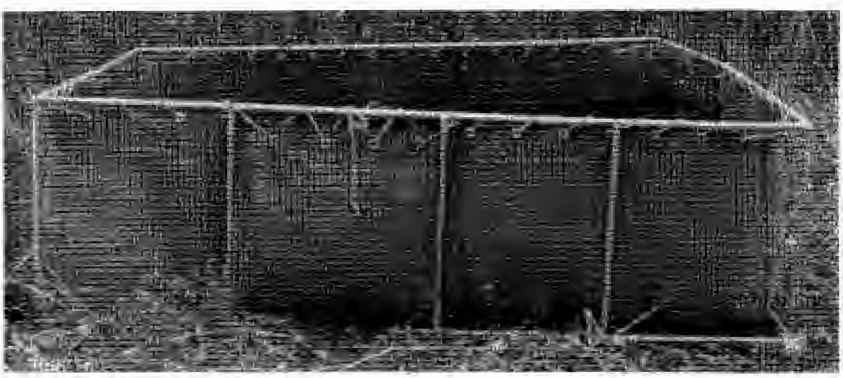


FIGURE 1.—1,000-gallon storage tank set up for use. The bulge in the second section from the left is the spillway. This section can be unlashed and lowered for quick emptying of the tank. In some tanks, it may be worthwhile to install a collar with a 1½-inch discharge port and cap near the bottom to permit the use of a gravity line instead of a siphon.

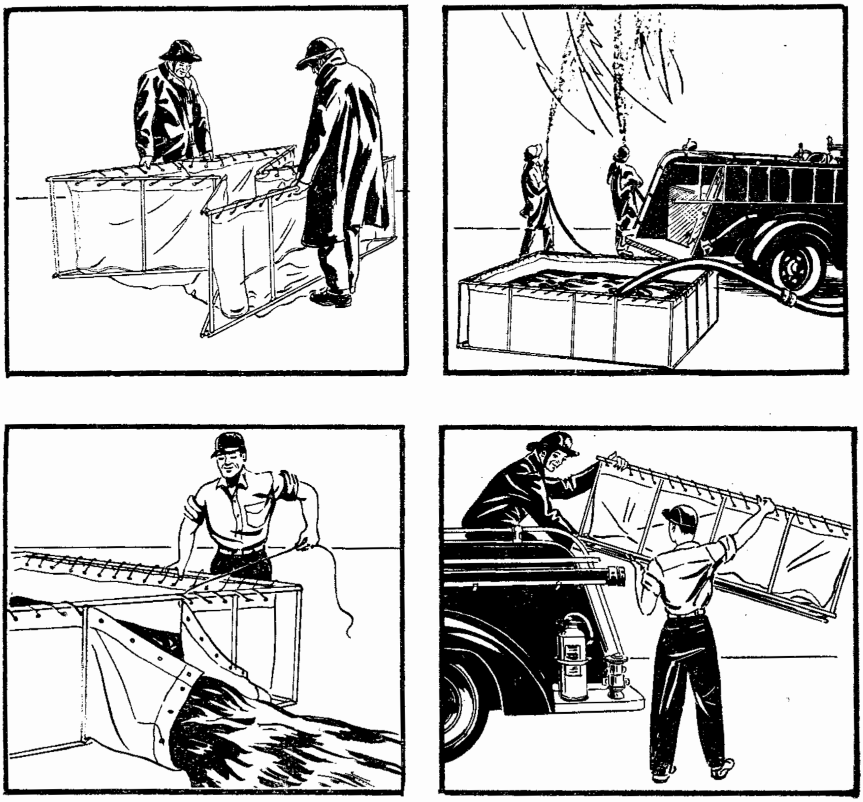


FIGURE 2.—1,000-gallon storage tank.

high; when folded it takes a space 8 feet 3 inches long, 30 inches high, and 10 inches wide. The frame is made of ¾-inch O.D. tubular steel, with welded joints and hinges. Liner material is No. 10 waterproof duck, mildew treated and vermin resistant; bottom and side seams are overlapped and double sewn. The canvas liner has grommeted holes to receive the heavy-duty, long-strand cotton, braided rope lashings. The tank weights 119 pounds and costs $179.50 f. o. b. the factory.

There is some seepage from the tank. The manufacturer states that it amounts to 20-25 gallons in the first 4 hours. Then the seepage gradually diminishes until, after 24 hours, it has practically ceased.

Gravity sock.—Gravity socks or intakes have been in use for years (fig. 3). They are included here, because there are many places where they can be used to fill the 1,000-gallon storage tanks. Tiny rivulets may not sustain a continued pumping operation, but the collection of this water into a storage tank will permit at least intermittent pumping or gravity use. Several intakes to collect ground seepage, such as occurs around springs, may even provide sufficient water for continuous use.

FIGURE 3.—Gravity intake set up for a gravity line. This water supply is sufficient for continuous use without a storage tank. There may be occasions, however, when bringing the water into a tank on a road will provide adequate water for several tank trucks.

Relay tank.—The primary purpose of a relay tank is to boost water to a fire at a higher elevation than could be reached by one pump alone. The usual method is to set up a pump at the water source and pump water into a canvas relay tank some 250-300 feet vertical distance above. At this point, a second pump is used to boost the water up the next leg of the relay, or to the fire, as the case may be. Relay tanks may fit very well into the overall canvas show, to bring water to a tanker filling point, direct to the fire, or to fill the storage tanks for either gravity or pumper operations.

A typical relay tank has a capacity of about 75 gallons. The canvas is treated, mildewproof duck, reinforced at all points of stress.

Transporting tanks.—This term is used to describe the self-supporting pyramidal tank (fig. 4). Since they are completely enclosed, they are ideal for transporting water in pickups, dump or stake trucks, or most any other type of vehicle. Available in 2 sizes, 150- and 300-gallon, they can be used to haul water to a 1,000-gallon storage tank. The 300-gallon size weighs only 24 pounds empty, and 2 of this size will fit easily on a 1½-ton truck. Present cost of the pyramidal tanks is $99 for 300-gallon and $83.50 for 150-gallon size, f. o. b. the eastern factory. They are mildew treated.

The Pacific Northwest region of the Forest Service has many opportunities to use canvas advantageously, especially in connection with fall slash burning. In calendar year 1954, 2½ billion board-feet of timber valued at more than 34 million dollars was

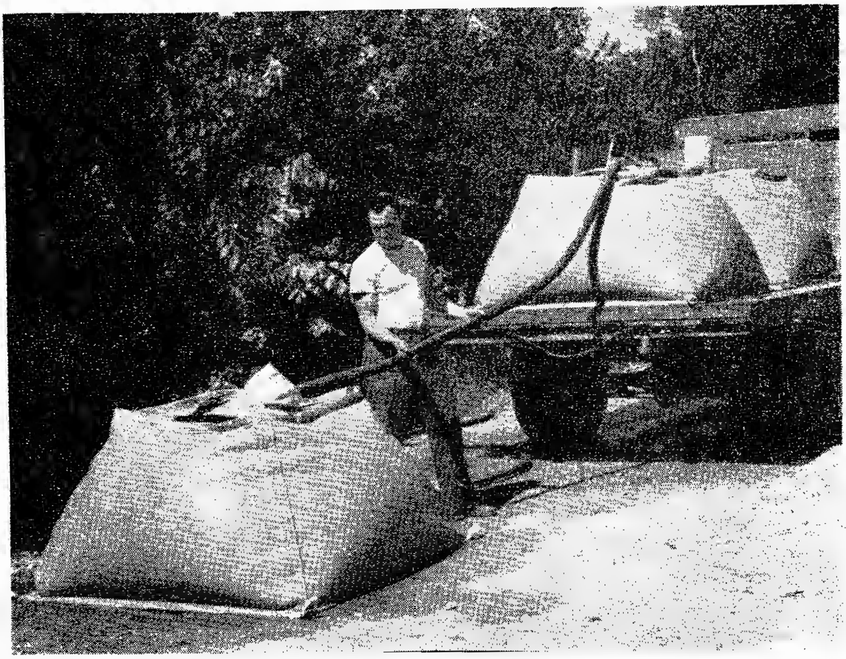


FIGURE 4.—Siphoning water into a pyramidal tank for storage.

cut on the national forests in the region. A volume of cut such as this produces a large and sometimes complex slash disposal problem. The time during which broadcast burning can be done is limited by weather conditions, but unlike the "regular season" fire, there is time for sizeup and advance planning.

Broadcast burning of slash offers an excellent opportunity to study fire behavior, and many of our men are becoming quite adept at recognizing possible trouble spots. More and more water shows are being laid out in advance to handle these expected critical areas.

The region has an average of 1.7 small slipon tankers per ranger district. The pumps on these slipons can be quickly removed and used in the same manner as portable pumpers. In addition there is an average of 1.5 portable pumps per district.

Access to the slash areas is no problem, and many of the cutting areas are on steep ground where gravity systems are a "natural." The 1,000-gallon storage tanks can be quickly moved from one cutting area to another. Any water-carrying vehicle can be used as a nurse tanker to keep them filled, and they in turn are a source for filling the small slipon tankers or for pump or gravity shows. These tanks are a welcome addition to our equipment.

FIRES ARE SMALLER ON THE APALACHICOLA RANGER DISTRICT

H. R. RAUM[1]

District Ranger, Florida National Forests

The total number of fires, most of them caused by lightning, has not substantially decreased since 1939 on the Apalachicola Ranger District. However, a greater percentage of these fires is confined to smaller size classes. A definite increase in percent of Class A and Class B fires is accompanied by a noticeable reduction in percent of Class C fires and a minor reduction in Class D and E (fig. 1). While this chart is not meant to represent regular and steady yearly progress in controlling fires when they are small, it does show the trend toward this goal over the 15-year period 1939-53. Protected national-forest acreage lost to wildfire annually has decreased from one-third of one percent during 1939-43 to one-fifth of one percent during 1949-53.

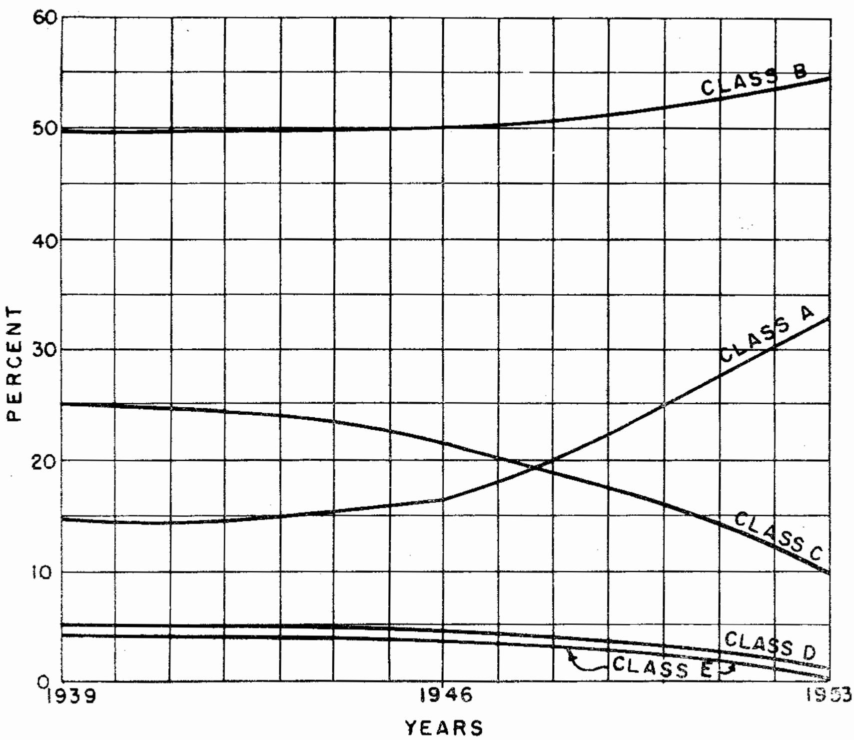


FIGURE 1.—Trend in percent of fires on the Apalachicola Ranger District by size classes, 1939-54.

[1]Now on the Supervisor's staff, North Carolina National Forests, Asheville, N. C.

Several factors have contributed to this trend. The increased use of mechanized equipment to replace manpower since the close of the CCC period is probably the most important. The chart indicates the beginning of the trend to smaller fires at about this same time. The Apalachicola Ranger District is equipped with heavy-duty tractors and plow units of the TD-9 Mathis type transported on 2½-ton tandem-drive trucks. Travel time to fires has been materially reduced by the change from semitrailer units to the present tandem-drive vehicles. The replacement of manually operated plows with hydraulic units and the development and use of tanker equipment has reduced fire control time. These factors have resulted in a corresponding reduction in area burned.

State highway construction in this district, together with construction and improvement of U. S. Forest Service roads, has speeded up control action, especially in the southern part of the district. In some areas travel time has been cut by two-thirds because of improved roads.

A carefully planned prescribed burning program, designed to form patterned barriers against large fires, has played an important role in the task of keeping down the size of wildfires. Prescribed burning was started in 1943 on this district; now about 20 percent of the net burnable acreage is prescribe burned annually.

We are compelled to depend almost entirely upon U. S. Forest Service crews for suppression action. There are no sources from which to obtain large crews of fire fighters within reasonable time limits. The fact that fast spreading fires in flash fuels can start within a few hours after a rain, together with yearlong fire occurrence, requires that we apply all available means of controlling fires while they are small.

INEXPENSIVE ELECTRIC STARTER FOR PORTABLE PUMP ENGINES

MELVIN A. FREYTAG
District Forester, Ohio Division of Forestry

The starting device described here was designed and built by fire control personnel of the Ohio Division of Forestry, New Philadelphia, Ohio, at a cost of $28.43 for materials. It was designed to remedy engine starting difficulties experienced with a new truck-mounted portable pump. This starter has now undergone sufficient testing to assert that it efficiently fulfills its purpose.

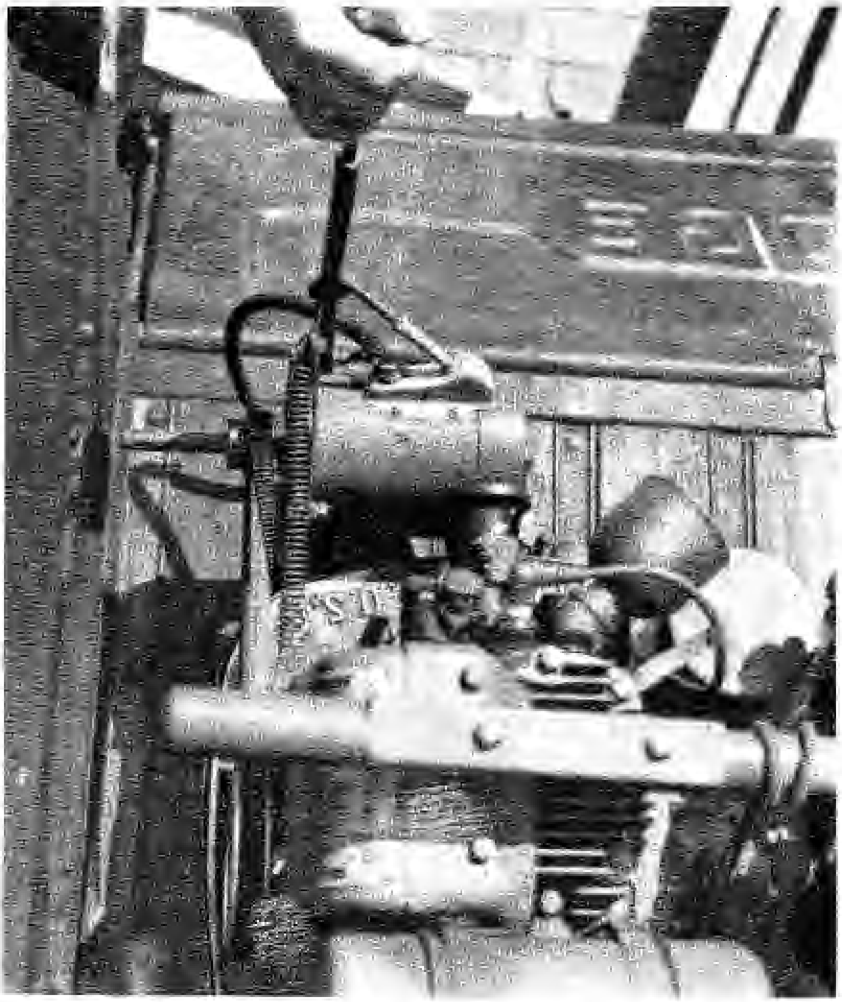


FIGURE 1.—Pulling the starter handle tightens drive belt; moving it toward switch will close contact and start motor.

The principal part is a rebuilt, 6-volt automobile starter motor that is powered through cable connection to the truck storage battery. Power is transmitted by a V-belt from a 2-inch V-pulley on the starter to a 5-inch V-pulley mounted on the pump engine. The starter, which is hinge mounted, is held in a non-operating position by a coil spring. A handle is mounted on the starter swinging it away from the pump motor and so placing tension on the drive belt. Side motion of the handle permits activating the starter at the same time tension is applied (fig 1).

To operate starter, pull handle until sufficient tension is applied on the drive belt to transmit the power. Then, move handle sideways toward switch to close the contact and start motor. When pump engine starts, release tension on starter handle so coil spring can return starter to a forward, nonfunctioning position. Remove drive belt from rotating engine pulley to prevent wear.

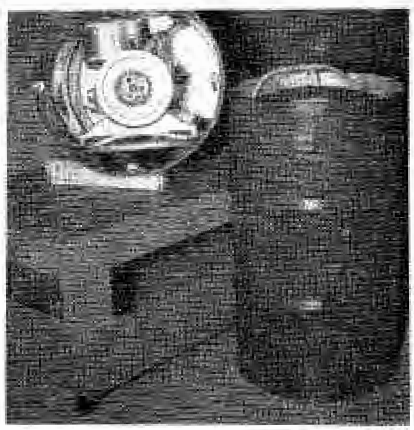
The starter can be detached easily from its base to permit removal of the pump. The pump engine can be started in the field by use of a standby starter rope.

☆ ☆ ☆

Oil Drum for Parachuting Portable Pumper

Parachuting pumper equipment to fire fighting crews in the back country may spell the difference between a fire getting away or being controlled while small. A 35-gallon oil drum container has been used successfully to protect a portable pumper dropped by parachute.

The top of the drum is cut out and the pumper, mounted on a metal pack frame, is bolted by four wing nuts to the inside of the drum near the top. The pumper is suspended approximately 4 inches off the bottom. Four rings are bolted to drum near the top for fastening the parachute. The container is disposable. Total weight of container and pack frame is about 37 pounds, with "Y" pumper, 107 pounds.



When the smaller 38-pound pumper unit is used, in addition to the pumper and metal pack frame, the container holds an accessory kit, 1 gallon of gas, and 500 feet of 1-inch linen hose. The 5 rolls of hose are placed in the bottom of the container; then the pumper is placed in position and bolted in. The gas and accessories are placed on top of hose and the unit is ready. The complete outfit, including container, weighs 156 pounds.—LOUIS F. DEYAK, *Fire Control Aid, Superior National Forest.*

METAL PACK FRAMES FOR PORTABLE PUMPERS AND POWER SAWS

LOUIS F. DEYAK
Fire Control Aid, Superior National Forest

Pack frames are often necessary for carrying portable pumpers and power saws. The familiar wooden pack frame served the purpose, but had the disadvantage of excessive weight, joints became loose after limited use, wood became oil soaked, and the frame was hard to construct. A wooden frame sturdy enough to stand the wear was too large and cumbersome.

A metal pack frame with welded joints, which eliminates all of the above disadvantages, can be easily constructed from ½-inch thin wall conduit (fig. 1). It weighs half that of the wooden frame and costs about $12.

These materials are needed:

1 10-foot length of ½-inch thin wall conduit.
6 ¾-inch harness rings.
4 ¾-inch harness buckles.
4 3/16- by 2½-inch stove bolts with wing nuts.
1 4-foot length of ¾-inch leather strapping.
1 14-foot length of condemned 1½-inch linen fire hose.
2 webbed shoulder straps (as used on fire backpack pumps).

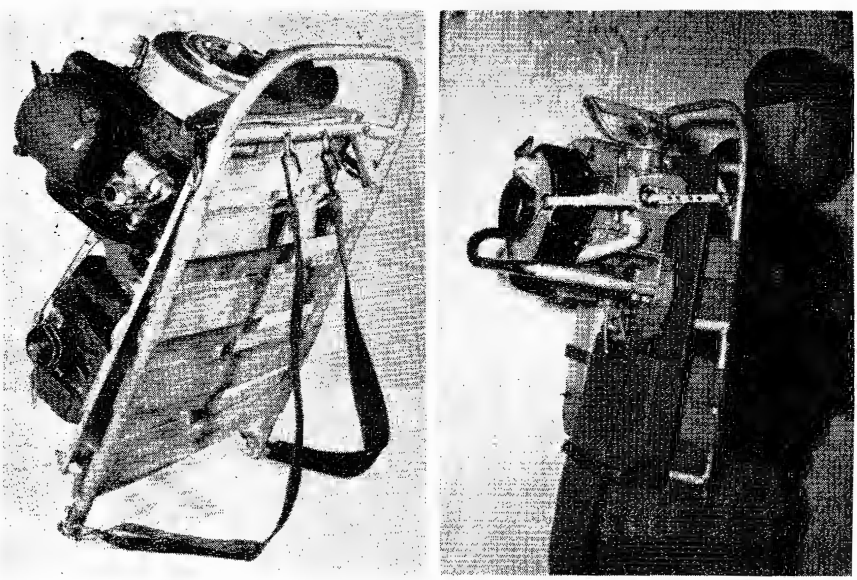


FIGURE 1.—Metal pack frame: *Left,* portable pumper bolted down; *right,* power saw in place. The four lengths of 1½-inch linen fire hose are pulled tight by means of ¾-inch harness buckles and leather strapping riveted to the ends.

A portable pumper with accessory kit and suction hose can be mounted as a compact unit weighing 64 pounds on the metal pack frame. The 1-inch suction hose is wrapped around the pumper and tied.

The mounted saw is a complete unit weighing 50 pounds. The accessory box is made as part of the pack frame and contains an extra saw blade, pliers, 6-inch screwdriver, 8-inch adjustable wrench, ⅝-inch socket wrench, spark plug wrench, one connecting link and rivet assembly, extra spark plugs, a few extra cutters and rakers, quart of oil for oil reservoir, and notebook and pencil. The saw is very easily dismounted from the pack frame by loosening 2 wing nuts which hold the beaver tail in place, loosening the strap which holds the saw to the pack frame, and lifting up.

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Rear-Step Push Button for Enclosed Cab Fire Trucks

Safety is a major concern of every fire chief. Here is one device that has paid dividends in added safety. Push buttons have been installed on nearly all the fire trucks of the Central Rhode Island Firemen's League. The button is within easy reach of the rear-step riders and activates a bell or buzzer in the driver's cab. A code is used to transmit emergency instructions to the driver.

This system of communication, long in use between tillermen and drivers of aerial-ladder trucks, was adopted by the West Greenwich Fire Department after a disastrous incident last year. Working close to the flames of a forest fire, one of the riders on the rear step had the misfortune to have his shirt catch fire. The flames, fanned by wind created by the truck's passage down the road, engulfed the unfortunate fireman. The other rear-step riders shouted to the driver to stop, but they could not be heard. The flaming man was forced to jump from the rear step. He was followed by two fellow firemen who promptly extinguished the flames. However, the burns suffered by this fireman were so serious that he was hospitalized for a long period.

The Hopkin's Hill Fire Department, on learning of the emergency communication installations on the West Greenwich Fire Department trucks, adopted the device for their own trucks. Shortly after rear-step push buttons had been installed, a dramatic proof of their usefulness was enacted.

While answering an alarm at 45 m. p. h. one of the fire trucks lost a tie-rod! A fireman, following in his own automobile, saw the tie-rod fall off. Quickly breasting the rear-step riders, he told them what had happened and to slow the racing fire truck gradually to a halt "so they wouldn't fetch up in a heap!"

Using the buzzer code, the rear-step riders instructed the driver to bring the truck slowly to a halt. Whereupon the driver jumped to the ground, demanding angrily to know what in blazes they thought they were doing! They pointed to the tie-rod being brought up by the fireman in the automobile and suggested it be put back on the truck before going any farther. This rear-step push button for emergency communication is a safety device of wide usefulness.—ANNE C. HOLST, *Cedar Hill Forest Fire Experiment Station, Cedar Hill Fire Department, Cowesett, R. I.*

AIR DELIVERY OF WATER HELPS CONTROL BRUSH AND GRASS FIRES[1]

JOSEPH B. ELY, *Fire Control Officer, Mendocino National Forest,* and ARTHUR W. JENSEN, *Forester, Division of Forest Fire Research, California Forest and Range Experiment Station*

Dropping water or fire-retardant chemicals from low-flying aircraft can help ground forces control brush and grass fires. That such water drops are practicable has been demonstrated by a recent series of field trials and calibration tests conducted by the Mendocino National Forest and the California Forest and Range Experiment Station in cooperation with the Willows Flying Service, the California Division of Forestry, and the Arcadia Equipment Development Center. As much as 120 gallons of water at a time was carried to fires in an airplane normally used for crop dusting and other agricultural purposes. Water dropped through a single outlet designed by the Willows Flying Service proved effective in quieting hot spots on large fires and in retarding spread of small fires in brush and grass.

Previous studies have established several guidelines for dropping water from aircraft: (1) The danger to men, equipment, and buildings prohibits the use of missiles or droppable containers—in fact, any projectile—in populated areas or as close support to fire fighters on the ground. (2) Aircraft must be maneuverable and have a considerable reserve of power. (3) Pilots should be capable of flying close to rough topography and of achieving pinpoint accuracy with safety. (4) Water dropped free-fall reaches the ground and has a significant effect on some fires.

In consideration of these guidelines, it was decided to test the adaptability of an agricultural aircraft as an aerial tanker, and to attempt drops of uncontained water on fires.

At the suggestion of the fire control staff of the Mendocino National Forest, the Willows Flying Service adapted a 450-horsepower biplane used in agricultural work for trial as an aerial tanker. The spray equipment connected to the 160-gallon tank in the fuselage was removed and a single outlet was installed at the base of the tank.

The outlet measures 7 by 18 inches and is constructed of heavy sheet metal. The outlet gate is hinged at the front and has a rubber gasket to insure watertight seal. At first, when the gate was opened by tripping a simple latch from the cockpit, the sudden release of water caused the plane to jump about 100 feet and the pilot to black out temporarily. This difficulty was corrected by equipping the outlet gate with a controlling lever which permitted the pilot to open the gate more slowly in all subsequent tests.

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[1]Reprinted in part from "Air Delivery of Water Helps Control Brush and Grass Fires," by Joseph B. Ely and Arthur W. Jensen. U. S. Forest Serv. Calif. Forest and Range Expt. Sta. Forest Res. Note 99, 12 pp., illus. 1955.

Preliminary trials conducted in early August 1955 over flat ground at an airport showed that water could be dropped successfully. In the first trial, 120 gallons of water was dropped from an elevation of 30 feet at an airspeed of 80 miles per hour. The water from this drop covered an area approximately 30 feet wide and 285 feet long. A test fire in grass, 20 feet wide and 600 feet long, required three 120-gallon loads of water and 10 minutes of follow-up work by hand for control.

The next step was to try water drops on actual wildfires. In three trials during August the air tanker proved to be of considerable help to ground forces although in one of these it was apparent that too much was expected of a single plane.

The Mendenhall fire of August 12 covered about 400 acres in grass, brush, and timber; crowning uphill; weather hot, dry, and windy. The plane supported initial action forces on flank in grass and mixed oak with 240 gallons of water in 2 loads. Support was effective where used, but there was too much line for one plane to handle.

With the weather hot, dry, and windy, the August 13 Mendenhall fire of 700 acres was temporarily controlled at head and one flank. Lower end of fire, burning downhill in chamise, became too hot to handle by direct attack and threatened to outflank existing control lines. The plane, refilling repeatedly at nearby airport, delivered 600 gallons in 5 loads to 15 chains of lower end of fire. Fire cooled down enough so that attack forces were able to build control line along fire edge. Fire fighters stated they could not employ direct attack until flames were suppressed by plane. In this trial, 120 gallons applied in 6 passes was not nearly so effective as when applied in 3 passes.

The John David place fire on August 15 was in bottom of narrow box canyon with adjacent slopes rising 2,000 feet on one side and 5,000 feet on the other. Cover consisted of medium-density mixed brush with grass. Head of fire controlled but hot-burning corner threatened to outflank control line. Corner too hot for direct attack and moving too fast for indirect attack. Refilling at nearby airport, plane delivered 480 gallons in 4 loads to hot corner by flying up and down the canyon. Water cooled down hot corner enough to allow men to complete their control line close to fire edge. District ranger and others reported air tanker instrumental in control.

On initial attack the loaded plane was dispatched from its Willows base immediately after ground forces were started to fire. At the same time, aviation gasoline and a water tanker were sent to the airport nearest the fire. A reconnaissance plane, in communication with ground forces and the "refill" airport, correlated the ground and air activities. In the future the company plans to fly a maintenance mechanic to the airport to refuel and load the air tanker, do maintenance work as necessary, and prevent damage to the plane by well-intentioned but inexperienced personnel during the loading operations.

It was apparent that air delivery of water made this aircraft a practical fire fighting tool, but quantitative information was needed to improve tactical methods for water delivery. Accordingly, a limited series of tests was conducted to obtain the following information: (1) Effect of plane height, plane speed, and wind velocity and direction on amount and distribution of water received on the ground. (2) Amount of water loss to be expected during summer fire weather. (3) Effect on amount and distribution of dropping part of total load in each of several runs (multiple passes) with pilot aiming for same spot each time. (4) Practicability of dropping a sodium-calcium borate fire-retardant. (5) Amount of penetration of water and retardant into brush cover.

Although this aircraft can carry a maximum of 160 gallons of water, nominal full-load tests were made with 125 gallons of water or 100 gallons of retardant. At elevations normally experienced on the Mendocino National Forest this is the maximum safe load.

During the tests wind velocity varied from calm to 8 miles per hour, air temperature from 80° to 110° F., and relative humidity from 6 to 19 percent.

The patterns of distribution from these tests were roughly oval, from 4 to 7 times longer than wide. When the full load was released in one pass the greatest concentration of water was obtained when the airplane was flying at low speed and low elevation into the wind. Both higher speed and greater elevation increased the total length of pattern but gave lower concentration.

About 75 percent of the water reached the ground in measurable quantities in the low-altitude, low-speed, headwind tests; about 65 percent in the higher altitude, cross wind tests. At top speed and low elevation, about 70 percent of the water released reached the ground. Only 20 to 30 percent of the water reaching the ground was in concentrations of 1 gallon or more per 100 square feet. Apparently, wind direction and velocity are the most important factors affecting percent of water reaching the ground in a useful pattern.

Relatively high concentration was obtained when a 40-gallon load was dropped in one pass as compared with a 125-gallon load dropped in multiple passes. In making more than one pass with a capacity load, the manually operated outlet gate was only partially opened for each pass because it could not be closed against a full-stream discharge. As a result, only about half of the water reached the ground in measurable quantity. More rapid release of water should result in greater concentrations for all sizes of loads.

In medium and light brush there was no significant difference between the amounts of water received at the crown and on the ground. In heavy brush, however, there was considerable variation—from 20 to 90 percent as much water reaching the ground as was received at crown level.

Results from the retardant tests were similar to those obtained with plain water. However, the heavy sodium-calcium borate suspension, weighing 10 pounds per gallon, did not disperse as readily as water and had a smaller distribution pattern with particularly heavy concentration in the center. Penetration into heavy brush was more uniform than with water; 45 to 60 percent of the amount received at the crown level reached the ground. The standing brush was well coated with retardant.

Conclusions and Recommendations

These limited tests have shown that water or chemical dropped free-fall from small airplanes can have significant effect on small grass and brush fires, or on some parts of large ones. To obtain the greatest concentration of liquid on the ground, the airplane should fly as low and as slowly as conditions permit and as nearly into the wind as possible. The more rapidly water is released, the greater the concentration will be. Increasing the altitude or air speed or dropping in a crosswind will give greater area coverage but will reduce concentration.

As with all specialized tools, the aircraft used for aerial tankers must be in top mechanical condition. Also, pilots must be experienced both in flying under mountain conditions and in low-level air drops. Pilots are cautioned to watch for sudden jumps when releasing large amounts of water. They should avoid a tail-down plane attitude when dropping from low heights to minimize effects of slipstream on the water.

One aerial tanker has been of significant assistance to ground crews on fires. Indications are that several planes used in quick succession will not only be more efficient but may be able to hold temporarily short pieces of hot fire line. It is not necessary to evacuate the target area as these uncontained water drops are not dangerous to personnel.

Considerable work still needs to be done before the aerial tanker can become a common fire fighting tool. The optimum speed, altitude, direction of flight, and method of releasing the water or chemical for each tactical situation need to be determined. Information is needed on the amount of water or chemical required to affect fires under different fuel and burning conditions. More test drops should be made under a greater variety of weather and fuel conditions, particularly at wind velocities greater than those encountered in these tests. A means of closing the outlet gate against a full stream of water is needed to permit higher concentrations of water than are now possible in multiple-pass drops. Ground-to-air communication should be improved for better tactical use.

PACKBOARD HOSE LAY

FIRE CONTROL PERSONNEL
Cajon Ranger District, San Bernardino National Forest

During the past two fire seasons, the Cajon District of the San Bernardino National Forest has developed a quick and efficient system for making a hose lay, by use of hose packed on a packboard. Where tankers cannot get close to a fire, a 600- to 800-foot hose lay can be run and water delivered at the nozzles in 2 minutes.

The pack consists of 100 feet of 1-inch cotton jacket or 200 feet of 1-inch nylon jacket hose, packed on a 10- by 21-inch packboard. The hose is tied to the packboard in such a manner that it will come off easily and not become tangled (fig. 1).

Using 100 feet of the cotton jacket hose, the packing is started with the male connection or nozzle first (fig. 1, *B*). The hose is then folded lengthwise on the packboard until there are 7 folds (hose overlaps the ends of the packboard about 3 to 4 inches). This layer is then tied tight in 3 places, using 2 strands of cotton string at each place. Ordinary light cotton string is used because it will break easily when the hose is run out.

After the first layer is securely tied, the second layer is placed on top of it with seven folds and the ends even with the bottom layer. This layer is then tied tight to the packboard with more string (fig. 1, *C*). The last layer has six folds, ending with the female connection on the side and near the bottom of the pack (fig. 1, *D*). This last layer is also tied to the packboard with string. To insure against the pack coming apart before it is ready to use, the whole pack is tied with two straps that are fastened to the packboard (fig. 1, *A*).

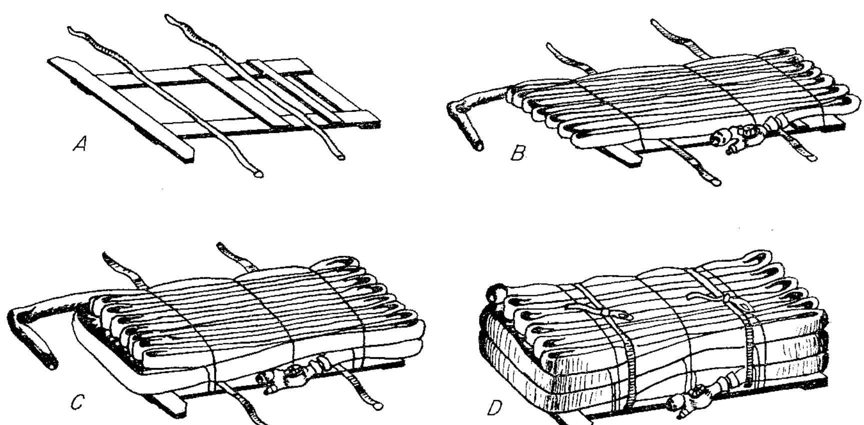

FIGURE 1.—*A*, Packboard ready, with straps, for loading hose; *B*, *C*, *D*, layers of hose properly placed and tied.

If 200 feet of nylon jacket hose is used, the procedure is the same, except the first layer of hose has 14 folds. The second layer has 13 folds, and the third layer 12.

One siamese hose lay, of which many variations can be used to meet varying conditions, requires a 5-man crew with at least 1,000 feet of hose. Initial hose lay consists of 200 feet of 1½-inch cotton jacket, rubber-lined hose, 800 feet of 1-inch nylon jacket, rubber-lined hose in 4 packs, a 1½- to 1-inch reducer siamese shut-off valve, a 1-inch siamese shut-off valve, and 2 nozzles.

Foreman carries packboard with 200 feet of 1-inch hose and nozzle, and pulls 1½-inch hose with reducer siamese out 200 feet from tanker. To the siamese he attaches the hose packed by No. 1 nozzleman who is following 20 feet behind him. Foreman, No. 2 nozzleman, and utilityman proceed 400 feet out to position for 1-inch siamese. Utilityman hooks foreman's hose to one side of siamese and No. 2 nozzleman's hose to other side. Foreman starts flanking fire in one direction, No. 2 nozzleman in the opposite direction. When No. 1 nozzleman arrives with more hose, the foreman gives him nozzle and is then free to direct action on fire.

No. 1 nozzleman, who has been 20 feet behind foreman helping pull 1½-inch hose, proceeds 200 feet after his hose is hooked up to siamese. He then hooks the utilityman's hose to the hose lay, and returns to siamese to await signal from utilityman to turn on water. After turning on water, he takes pack with 200 feet of hose, which has been brought to the first siamese by the truck operator, and proceeds out hose line to relieve foreman of nozzle. The hose he is carrying is extra.

Utilityman takes packboard with 200 feet of hose and the 1-inch siamese. He follows 20 to 30 feet behind No. 1 nozzleman and helps pull 1½-inch hose. He stays behind No. 1 nozzleman until 200 feet beyond first siamese. Here his hose is hooked into hose lay, and he follows foreman 200 feet to where he attaches second siamese. He then signals No. 1 nozzleman for water to this point. After this, he hooks foreman's hose to one side of siamese and No. 2 nozzleman's to the other. He then controls the water from this point or can go after tools and more hose.

No. 2 nozzleman, carrying packboard with 200 feet of hose and nozzle, follows 20 to 30 feet behind utilityman and helps pull 1½-inch hose. When he reaches second siamese his hose is hooked up to one side and he proceeds 200 feet around fire.

Tank truck operator checks truck and starts pump to charge 1½-inch line to first siamese. He takes shovel and packboard with 200 feet of hose to the siamese and then stands by where he can control the pump or the siamese in case of broken hose. He also acts as utilityman in relaying hose or tools.

FIRE EXTINGUISHERS, THEIR TYPES AND USE
V. VAPORIZING LIQUID

A. B. Everts

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

Vaporizing liquid is perhaps the best known, after water, of the extinguishing agents. This type of extinguisher[1] is often referred to as a "Pyrene," which is the name of only one of the many companies that manufacture this particular type of pump-gun. The layman thinks of vaporizing liquid as carbon tetrachloride (referred to as CTC), but this is not the only one or even the best. And therein lies the renewed interest in vaporizing liquid. Many compounds, with long names, are still undergoing tests and the best one probably has not yet found its way into general use.

Vaporizing liquid, as the name indicates, is a liquid that when directed on a fire quickly vaporizes into gas. The gas smothers the fire. An intense fire will bring about quicker vaporization than a smoldering fire. Since a smothering agent will not cool the burning fuel, vaporizing liquid is not as effective on Class A[1] fires as a quenching and cooling agent; that is, water or foam. However, vaporizing liquid (VL) will, and has, extinguished many small fires of this type. Success depends on the type of fire. Paper burning in a metal wastebasket, for instance, can be quickly snuffed out by VL (as by CO_2), but fires in overstuffed furniture, wood, or other deep-seated fires are not that easily handled. Reignition will quickly follow. VL is rated as a Class B and Class C extinguisher, but because of its knockdown of small Class A fires, it is often thought of as a universal type of extinguisher.

In a series of test fires, 8 pounds of pine needles making a layer about 2 inches thick in a 4- by 4-foot frame were used. The fire was extinguished only once by ½ quart of CTC; in other attempts, reignition occurred immediately. This is why timber fallers using power saws on national-forest timber sales in some regions are required to carry a shovel. The small extinguisher may handle a small gasoline fire, but when the fire involves forest fuels, a shovel is needed to build line or throw dirt.

How to use the extinguisher.—On Class A fires, direct the VL stream at the base of the flames. On Class B fires (flammable liquids) best results are obtained when the discharge from the extinguisher is played against the inside of the wall of the container, just above the burning surface. The stream should not be

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[1]For more information on classes of fires and types of extinguishers see: *Fire Extinguishers, Their Types and Use. I. Carbon Dioxide Extinguishers, II. The Dry Chemical Extinguishers, III. Water-type Extinguishers*, and *IV. Foam Extinguishers*, by A. B. Everts. Fire Control Notes 15 (4): 1-5, illus. 1954; 16 (1): 9-12, illus. 1955; 16 (2): 24-26, illus. 1955; 17 (1): 12-13, illus. 1956.

directed into the burning liquid. Where possible, the operator should walk around the fire while directing the stream so as to get maximum coverage during the discharge period.

On Class C fires, especially fires in live electric motors, VL is an excellent extinguishing agent. The reason is that the stream can be directed into the small openings of the motor housing easier than is possible with CO_2 or dry chemical. There is no danger from electric shock and no residue is left on the motor.

Types of VL extinguishers.—There are a number of types and sizes of VL extinguishers:

1. The hand pump type, which has ben in use for many years, is manufactured in a number of sizes: 1-, $1\frac{1}{4}$-, $1\frac{1}{2}$-, and 2-quart, and 1-, 2-, and 3-gallon.

2. Stored pressure type (figs. 1 and 2). All the major manufacturers now make VL extinguishers that can be pressurized with air, CO_2, or nitrogen. This type has a gage by which the pressure can be easily checked to insure that the extinguisher is properly charged. Internal pressure is usually 150 pounds. Most of these are 1-quart size.

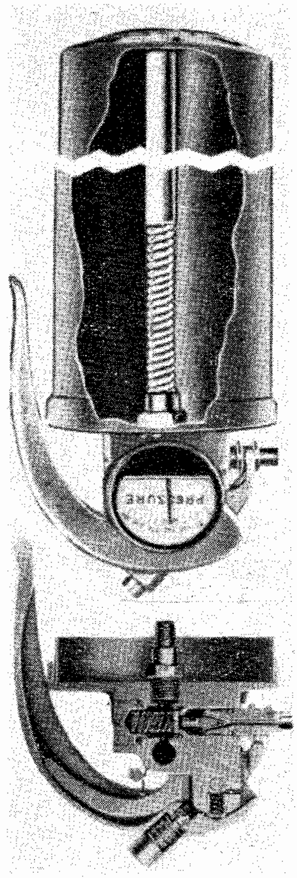

FIGURE 1.—Cutaway of a stored pressure VL extinguisher. The inside siphon tube is flexible so that more of the liquid can be discharged when the extinguisher is in a near horizontal position.

These extinguishers can be charged directly from a service station air chuck, the same as is used to inflate tires. All service stations, however, do not carry 150 pounds' pressure on their compressors. CO_2 is favored as a pressure medium. However, if CO_2 is used in cold climates, the pressure decreases as cold weather sets in. The pressure can be brought up to the recommended 150 pounds, but as spring and summer come around again, some of the pressure should be drained off. This can be done by turning the extinguisher upside down and releasing some of the CO_2 gas.

3. "One-shot" disposable extinguishers. These contain 16 ounces of CTC and are pressurized with CO_2. A small copper tube runs to the bottom of the can. To put the extinguisher into use, a ring is pulled to break the copper tube where it is crimped at the top of the can. These extinguishers are comparatively cheap.

4. The little 8-ounce pressurized extinguisher that is carried by many timber fallers for use on power saw fires. The agent in this extinguisher is chlorobromomethane (CBM).

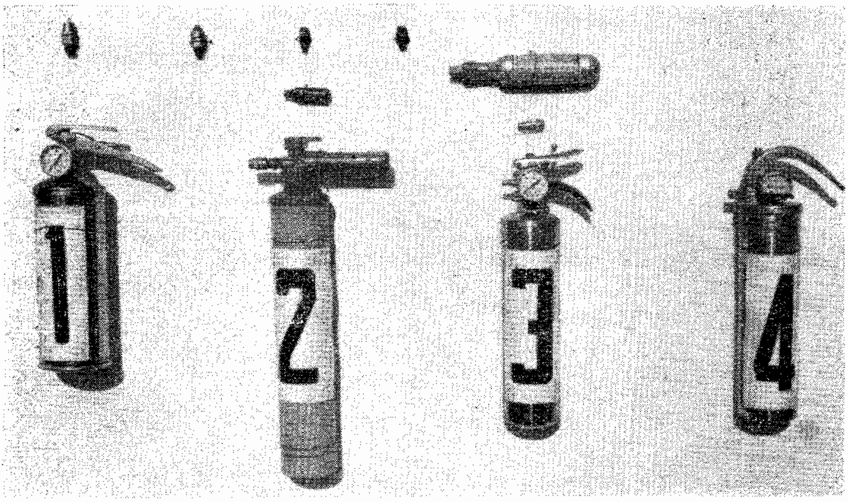

FIGURE 2.—Extinguishers 1, 3, and 4 are all 1-quart VL stored pressure extinguishers. All have pressure gages. Extinguisher 3 can be pressurized in the field with the large CO_2 cartridge shown above it. Extinguisher 2 is a 1⅜-quart water type of extinguisher known as "aircraft type," and designed for Class A fires in cabins of airplanes. It is pressurized with a small CO_2 cartridge which is inserted in the handle and ruptured (by turning) when put into use. The four small objects, upper left, are small capacity fog nozzles used on these extinguishers in an experiment to see whether fog is more effective than a straight stream.

While all these extinguishers were designed for using vaporizing liquids, there is no reason why they cannot be used for expelling any kind of liquid. A fog tip will give spread, if such is desired. The aircraft type, using plain water, is good protection for Class A hazards in the home. A fire retardant can also be used. There is a wide price range depending on the type and size.

Types of vaporizing liquid.—There are a number of vaporizing liquids used in fire extinguishers:

1. Carbon tetrachloride is the best known and the cheapest. It is treated with components for depressing the freezing point to 50° F. below zero.

2. Chlorobromomethane (CBM), aslo called bromochloromethane, is a German discovery. It is claimed that 1 pound of CBM is equal to 2 pounds of CTC. It will not freeze at temperatures above 100° F. below zero. CBM is more expensive than CTC.

3. Azeotropic chloromethane (CM-7) is still another compound recently developed which, it is claimed, will not produce toxic gas as the result of application to a fire.

4. Bromotrifluoromethane has shown remarkable extinguishing ability in tests conducted by the Navy.

There are others. Some of them are used in mixtures with methal bromide and with ethyl bromide. Research objective is to find a low freezing point liquid, with the greatest fire extinguishing ability, without a hazardous release of toxic gas.

WARNING: Too much stress cannot be placed on extreme care in the use of VL fire extinguishers in enclosed places. This is especially true of CTC. It should never be used as a cleaning solvent. Take heed to Robert Palmer, Industrial Hygiene Engineer, Oregon State Accident Commission, who reported: "No intelligent person would think of running his automobile in a garage with the doors closed, yet carbon tetrachloride is *four times as poisonous as carbon monoxide.* It is nearly half as dangerous as deadly hydrogen cyanide. Phosgene gas, produced when carbon tetrachloride comes in contact with any hot surface, is *ten times as toxic as hydrogen cyanide.* Three-fourths of a teaspoonful of carbon tetrachloride, evaporated and equally distributed in the air of a room 10 feet long, 10 feet wide and 10 feet high, will produce a toxic concentration. Just three drops of carbon tetrachloride, sprayed onto a fire and converted into phosgene will affect the health of a person in the same room . . . .

"There are many more cases of minor to severe carbon tetrachloride poisoning on record, and no one knows how many unreported cases because the symptoms of carbon tetrachloride poisoning are often just like kidney or liver ailments of an organic nature. Also the effects are often slight and temporary. That is, they seem to be temporary, but the damage done by carbon tetrachloride is permanent and the effects may not show up for months or even years after exposure and the unfortunate victim may have forgotten that he was ever exposed at all."

If you are depending on CTC for home protection for an oil furnance or stove, or for an electric range, be sure you, your wife, all members of your family are aware of this hazard. It is probably safer to change to CO_2 or dry chemical.

Maintenance.—The principal point in connection with maintenance of CTC extinguishers is to use a good grade of liquid, not the type that is used for cleaning. In inspections, pour the liquid into a clean container. If a gray scum is detected it is probable that the liquid is of inferior quality and that water is present. Even a minute amount of water will form hydrochloric acid which will cause corrosion.

Always make sure that the discharge port or nozzle is open and that the pump operates correctly. In the pressurized type, check the gage to be sure the pressure is right.

The manufacturers say "never use water in the extinguisher." What they really mean is that water should not be used to test the extinguisher because of the danger, as stated above, of forming hydrochloric acid when the extinguisher is filled with CTC again. There is no reason why these extinguishers cannot be used as "water type" extinguishers, especially with retardants and a noncorrosive wetting agent.

Summary.—(a) The VL type extinguisher is for flammable liquid fires and for fire in electrical apparatus. It is also effective on some types of small fires in paper, textiles, wood, or similar debris. (b) It is by far the most dangerous (if vapors are breathed) of all the five common types of extinguishers. Anyone who might use the extinguisher should be warned of the hazard. CTC in contact with flame forms gases that are dangerously toxic. All other chemicals are reported to be toxic to some degree. (c) Range of projection varies according to pressure medium, type of extinguisher, and whether the liquid is discharged in a spray or straight stream (20-30 feet in some straight stream types). (d) Costs cover a wide range, depending on type and size. (e) Maintenance requires an annual check and use of a good grade liquid.

Grenades and spray devices.—In addition to the extinguishers already described, there are a number of grenades meant to be thrown at a fire. There are also wall and ceiling spray devices, some of them pressurized with CO_2, with fusible links which will bring about automatic release when the temperature reaches 160° F. Many of these are excellent when properly installed, but it is obvious that a toxic agent should not be used in such devices in any location where there is the possiblilty of the released fumes or gases being breathed by humans.

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Portable Fuel Moisture Scale

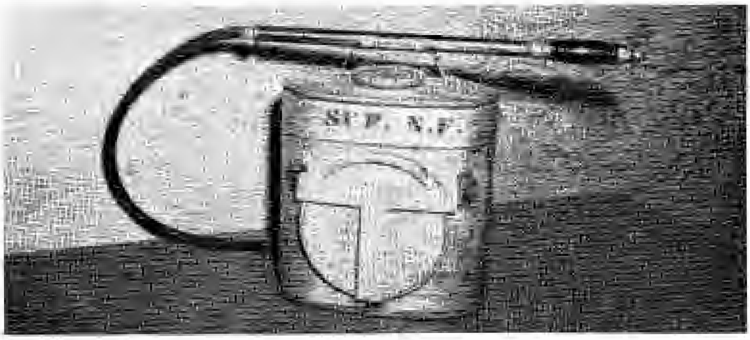
Increased research in fuel moisture problems and increased interest in using paired sticks in the timber edge and in the slash as a guide to slash burning raised a demand for a portable fuel moisture scale that could be carried from station to station. Since none was available, the standard scale was adapted in the following manner.

A level vial was secured to the face of the scale near the graduation arc. The scale was then put into a vise and the standard 100-gram weight attached to the balance in the usual manner. With the slide set at 100, the scale was then rotated to obtain a reading of "0." In this position the level bubble was set to read level. To operate, the scale is held at the top edge by the right hand and rested vertically on any support. The fuel moisture sticks are hung on the scale, the level bubble is brought to center and held there while the fuel moisture is read from the graduation arc in the usual manner.

Because some situations do not provide a place to rest the scale, a staff with brackets was provided. This staff is a standard ½-inch by 4-foot dowel rod with a short pin in one end. Two small angle aluminum brackets were attached to the center back of the scale plate. The bottom one had a ½-inch hole drilled and reamed to allow the dowel to slide freely. The top bracket had a smaller hole for insertion of the pin in the dowel. To operate, the dowel is slid through the bottom bracket and the pin inserted in the top bracket. The staff is rested on the ground, the scale grasped in the right hand and the fuel moisture read as previously explained.

In some locations, wind swinging the sticks is a problem. This can be solved by a sheet of metal bent in a "U" and staked in a vertical position at the site. The scale is then rested in a position so that the sticks hang inside this wind deflector. A similar wind shelter may be made by driving three 1- by 6-inch picket boards into the ground.—WILLIAM H. LARSON, *Chief Fire Warden, Washington Forest Fire Association.*

Bracket on Backpack Can for Canvas Bucket



A T-shaped bracket, cut from medium-gage galvanized tin, is soldered to a backpack pump can. This is a handy way to keep a collapsible canvas bucket readily available for filling the pump.—LOUIS F. DEYAK, *Fire Control Aid, Superior National Forest.*

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Fire Prevention Note

During the 1955 hunting season, the Coconino National Forest, Southwestern Region, used a short form letter as a means of contacting hunters and campers who were not in camp at the time the fire prevention guard or patrolman passed by. The mimeographed letter was printed on golden-orange paper to obtain greater legibility and as a reminder of the Forest Service Golden Anniversary. It read as follows:

Dear Mr. Hunter:

One of your Forest Rangers has visited your camp while you were out. The reason you probably picked this spot to camp is that it is located in a place you thought to be clean and beautiful. When you are ready to leave, please look at it once more and ask yourself if it looks the same as you found it. Others will appreciate anything you do to help keep your camp and the woods clean.

As you know, the forest is extremely dry and FOREST FIRES may start at any time. Please build your campfire on bare ground, in a safe place, away from logs, brush and litter. Make sure your fire is DEAD OUT whenever you leave camp. The Ranger who visited your camp may have some suggestions to make that may help you.

1. ....

2. ....

Thank you for your cooperation. Please stop one of our fire patrolmen if they can be of assistance.

Good luck on your hunt.

Very truly yours,

Forest Supervisor

By

There was also sufficient space on the form for the patrolman to offer suggestions that would help the sportsman to enjoy his stay in the Forest.

(This is a good reminder of a practice used from time to time in various other Forest Service regions. For example, the "courtesy ticket" includes smoking rules in effect at the time. Thus, the visitor is informed on the specifics of safely using his Forest playground.—Ed.)—Franklin O. Carroll, *Assistant Fire Staffman, Coconino National Forest.*

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TV Helps Prevent Forest Fires in Texas

Texas leads the Nation with 35 television stations operating in the State. Construction permits have been issued for an additional 10 stations. There are more than 90,300 television sets on Texas farms and ranches—nearly 1 for every 3 rural homes.

Approximately 25 percent of all woods fires in Texas in 1954 were caused by hunters. To discourage them from smoking game out of hollow trees and otherwise causing forest fires, much of the fire prevention effort in the State is directed toward hunters.

Chester O'Donnell, audio-visual aids specialist, Texas Forest Service, has prepared a series of station-break slides. The fire prevention message, station call letters, and channel number appear on each slide. Brief fire prevention copy is provided for the announcer to read while the slide is in view.

Several other station-break slides on related subjects have been prepared and distributed to Texas TV stations. These include "Observe Arbor Day" and "Use Your Ash Tray." In addition, Texas television stations are making extensive use of educational forestry motion picture films and some live forestry programs.

Through the use of television the Texas Forest Service is bringing forest fire prevention messages to the homes of many people who were never reached before.—E. R. WAGONER, *Associate Forestry Educator, Texas Forest Service.*

INFORMATION FOR CONTRIBUTORS

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

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

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

Illustrations, whether drawings or photographs, should have clear detail and tell a story. Only glossy prints are acceptable. Legends for illustrations should be typed in the manuscript immediately following the paragraph in which the illustration is first mentioned, the legend being separated from the text by lines both above and below. Illustrations should be labeled "figures" and numbered consecutively. All diagrams should be drawn with the type page proportions in mind, and lettered so as to permit reduction. In mailing, illustrations should be placed between cardboards held together with rubber bands. *Paper clips should never be used.*

When Forest Service photographs are submitted, the negative number should be indicated with the legend to aid in later identification of the illustrations. When pictures do not carry Forest Service numbers, the source of the picture should be given, so that the negative may be located if it is desired.

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


SMOKEY
PLEASE BE CAREFUL...
with matches
with smokes
with campfires
with every fire!
SMOKEY
Remember-Only you can
PREVENT
FOREST FIRES