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VOL. 3 APRIL 1939 NO. 2

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# FIRE CONTROL NOTES

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A PERIODICAL DEVOTED
TO THE TECHNIQUE OF
FOREST FIRE CONTROL

FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE

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If there is any introductory or explanatory information, it should not be included in the body of the article, but should be stated in the letter of transmittal.

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Volume 3 Number 2

# FIRE CONTROL NOTES

## A Quarterly Periodical Devoted to the TECHNIQUE OF FIRE CONTROL

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FIRE CONTROL NOTES is issued quarterly by the Forest Service of the United States Department of Agriculture, Washington, D. C. The matter contained herein is published by the direction of the Secretary of Agriculture as administrative information required for the proper transaction of the public business. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., 15 cents a copy or by subscription at the rate of 50 cents per year. Postage stamps will not be accepted in payment.

The value of this publication will be determined by what Forest Service officers, State forestry workers, and private operators 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, personnel management, 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.

*Address* Division of Fire Control
Forest Service, Washington, D. C.

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# CONTENTS

# TRAINING OVERHEAD FOR SUPPRESSION WORK

LEE P. BROWN

*Training Officer, Region 2, U. S. Foreign Service*

Few people will disagree with the author's opening statement that executive errors have contributed to failure to handle large fires efficiently. Since most of our fire losses come from large fires, we might expect much thought and action to be focused on training designed to prevent such errors. The contrary is true if the 1937 index to FIRE CONTROL NOTES is a reliable mirror of thought. Under the subject of training there are but two entries. Radio, a tangible and relatively easy subject, boasts seven entries. Training is a dull and unimportant subject compared with airplanes, cooperation, and fire lines, according to the space used in FIRE CONTROL NOTES. The author converts this situation into a challenge to fire-control men. How can there be effective training for large fires until fire experts stop rushing from one thing to another long enough to digest what they know and agree on just what skills and mental habits should be emphasized in the training of men? The author does more than issue a challenge. He lays the subject out in such a way as to invite men who believe in the importance of training for big fire work to take a hand in developing a body of accepted ideas which training specialists can use.

Every conference of fire-control experts and every analysis of records of past fires emphasizes the fact that avoidable mistakes of personnel contribute, in some degree, to ineffective fire-suppression action on many large fires. Some of the personnel failures are the result of:

1. Mistakes in judgment—in timing, in planning, etc.
2. Failure to recognize potentialities.
3. Failure to function properly on the job because of inability to recognize place and duties in the fire organization.
4. Failure to see the job as a whole; this usually reflects inexperience.
5. Lack of administrative ability in organizing and directing crews.
6. Surrender to excitement, pressure, or fear.
7. Failure to apply knowledge of fire behavior, weather, etc.
8. Failure to adopt or combine techniques so as to secure the most effective action on fire.

## Selection and Training

If the fire organization is to be strengthened and personnel failures minimized, there are two problems to solve. First, the selection of men; and second, their training. The two are inseparably linked. Training is essential to proper development, but the better the foundation the more effective will be the training. Training may supply props for deficiencies inherent in the men, but props may give way under strain.

It is desirable that men selected to be developed for overhead positions in handling fires have certain personal characteristics. Some of the more important are:

1. Indicated ability to plan and organize, and particularly ability to correlate.

2. Marked aptitude for administrative work.
3. Good health, particularly stamina.
4. Proved ability to work calmly and surely under heavy pressure.
5. Good analytical judgment coupled with a high degree of initiative, originality, and a perceptive imagination.
6. Qualities of leadership which inspire confidence and build loyalty.
7. Knowledge of the physical limitations (endurance) of the human machine, particularly one's own.

Men with a reasonable proportion of such qualities can be developed by training into efficient leaders for a fire organization. Any training program, however, must weigh the cost of training against the results secured. Although it may be possible to develop men with more or less fundamental deficiencies, the period of training is too long, the cost too great, and the assurance of satisfactory performance too uncertain to warrant the attempt. The first problem then, is to analyze the job and determine qualifications on which a training program can be built.

Methods, practices, and programs for training lookouts, guards, firemen, scouts, and fire fighters are well developed and in general accomplish the purpose for which they are intended. Detailed analyses giving the responsibilities of overhead positions, such as foremen, camp bosses, sector bosses, and fire chiefs on suppression work, have been made. One such analysis held a number of officers in overhead positions responsible for several hundred items, each under a number of general functions or operations. If these analyses are representative pictures of the job, perhaps we are asking for something that taxes human capacity too heavily. Certainly they indicate the need for a careful, systematic build-up of the officer's knowledge of his job and ability to perform on the job if he is to function surely and effectively on large fires. Are we tackling this training problem in the same way in which "guard training" has been made effective in increasing the efficient functioning of our primary protection forces; or are we, because of the exigencies of fire suppression work, training our overhead by the trial-and-error method? If we use the latter, should we not charge a reasonable proportion of the errors up to training and not condemn the inexperienced officer for his mistakes?

## Overhead Training

In training overhead for large fire crews the major aims should be:

(*a*) To develop the trainee's knowledge of fire behavior;
(*b*) To instruct the trainee in different methods of fighting fire;
(*c*) To develop judgment of the trainee in accurate appraisal of fire behavior and in applying fire-control methods in a practical manner;
(*d*) To develop foremanship of crew leaders in handling men on the line;
(*e*) To give the trainee a knowledge of what is essential to good organization of fire-suppression forces and an understanding of how officer should function to operate efficiently;
(*f*) To develop the capacity of the trainee to organize, direct, and correlate the work of fire crews quickly and effectively (including the service of supply);

(g) To instruct the trainee in the mobilization and demobilization of large fire-suppression forces, their supplies and equipment;

(h) To develop the trainee's ability to recognize and appraise potentialities;

(i) To develop the trainee's judgment and skill in planning ahead so as to be in the best possible position for meeting such exigencies as occur;

(j) To give the trainee such guided experience and training that he will function confidently and surely under pressure on the job.

How can the instructor prepare himself for the job of training competent overhead for large fires? To what authorities and references can he turn?

In all the wealth of forest literature there is little on fire fighting that can be used as a text. One excellent, although brief, booklet on fire fighting is the one put out by the Western Forestry and Conservation Association. Another is the new Region 5 Fire Control Handbook.

Research has in its files a wealth of material on fire-suppression work, but little of it is available or usable for instructional purposes. The average officer who has to train or develop men for overhead positions on fires must rely for material largely on his own experience and his own habits or practices of fighting fire. He may be excellent in some phases, fair in others, and poor or inexperienced in a few of the tasks involved in a fire-suppression organization. The men cannot help but reflect the instructor's abilities and limitations. Under such conditions might it not be well to check up on the instructor as well as the officer who "blows up" in a fire organization?

So much for the general situation. The next step is to consider one by one the broad subjects indicated in order to get a better idea of how they should be handled in the development of an effective training program for overhead.

## Fire Behavior

Research has made some study of fire behavior, but only a small part of its findings has been presented in such form that it can be used for instructional purposes. Fire-control men apply their knowledge of fire behavior, but have rarely analyzed fires in terms of topography, physics, meteorology, or ecology. Where, then, do forest officers get their knowledge of fires? The answer is by experience on fires. The observant and those inclined to experiment can learn pertinent facts on fire behavior from an evening campfire on the trail, from a pile of burning brush, from slash disposal fires of various kinds, as well as from forest fires.

Fire behavior on small fires is pretty well explained in guard training. But is fire behavior the same on large fires? If it is, how can it be predicted for large areas? If it isn't, what differences are there and how will they affect the task of fire control? When and where, for example, may an officer expect cyclonic drafts on a large fire? Frequent reasons for unexpected loss of line on large fires are that "the wind suddenly changed," or "a big wind came up and swept the fire over the lines." Only occasionally, however, do weather records actually show any sudden, unusual, or material increase in wind velocities for that time of day. Has anyone ever tied the physical laws of gas or ether expansion to fire fighting? What combinations of topography, volume of heat, spread, weather, and the like may cause uncontrollable conditions? What indices may be used to foresee the approach of catastrophic conditions on the line? These are but a few of the questions a training officer must answer in developing and training officers on large fires. Your executive on a large fire must appraise fire behavior broadly; he cannot deal with it in minutiae. How can he be trained to do this?

## Methods of Fire Fighting

Methods and techniques develop from experience. Only in the last few years have we heard of the station method, the one-lick method, and other methods and variations, yet every officer of experience will recognize in each the fundamental theories he has seen used repeatedly on fires. Here again, there has been more of doing and less of telling by the men who have developed the techniques. Methods have not as a rule been clearly defined, because fire chiefs have not fought a fire by the use of any one method, but rather by a variation and combination of methods. For example, Jim Girard taught me the use of the station method "way back when." He did not call it by name, and he originally used it primarily on mop-up work. Before that, I had been introduced to what I may call a "squad method," although I have never heard it named, and a head fire guard taught me an early variation of the one-lick method several years ago. A forest supervisor expounded the theory of "cold trailing." But I got all of this on the fire line, never anywhere else, and it's only in retrospect that I see it as instruction or training.

Since most reasoning is from the concrete to the abstract, isn't it logical that our techniques develop from fighting fires—and not that fire fighting develops after techniques have been set up? Perhaps the previous thirty-odd years form an essential "cut and try" period. Be that as it may, the training officer's problem now is to isolate these techniques, instruct in them, and then train in the common-sense application of them in various combinations for efficient fire-fighting work. The end sought is the trainee's ability to combine and apply his knowledge of fire-behavior and fire-suppression technique effectively.

## Technical Judgment

Developing the judgment of an officer is difficult when dealing with concrete or physical things which must be appraised in order to arrive at correct conclusions or decisions. It is infinitely more difficult to develop judgment which deals with intangibles and potentialities and requires vision bordering on the prophetic. It can never be done with certainty where careful analysis and positive direction of the trainee's thinking and reaction is lacking. In short, the training of officers for overhead positions on fires requires the same long-time planned training and experience that is required to develop judgment in other important positions.

Is it not true that most firemen think in terms of their experience rather than in terms of fire behavior and methods? Start a discussion of fire behavior in a group of them and see how hard it is to keep the discussion going and how little they think in terms of fire behavior. Try the same thing in a discussion of fire methods and note the dearth of ideas. Watch the dog fight, however, when you toss an actual fire problem into the group. You will find varying points of fire behavior and of fire-suppression technique forming an ever-changing basis for discussion. Is this not a natural sequence of the way in which they have acquired their knowledge?

How often are the reasons back of fire strategy and important decisions on going fires explained to subordinate officers, who, in many instances, are admittedly in training? Have the key officers the time to do it while they are under pressure to get the fire? When should it be done? Where should it be done? How far should they go? Should they have the help of a training specialist? If so, what should their relations to each other be?

Get any group of fire-control devotees together and get them started on the problem of training fire fighters and the invariable conclusion is: "The way to learn to fight fire is to fight it. Every fire is different, you learn something from every one of them." For many years men have been sent to large fires for training. At least the value of the detail from a training standpoint has been considered. Is the training being done on such details effective? Is it enough? Should there be more training details to going fires? If the way to learn to fight fire is to "go fight it," shouldn't every major fire be made a training ground for junior or inexperienced officers? Here by common agreement seems to be the ideal place to train officers in fire-suppression work. Yet the results of this method so far have not been free from some disastrous failures. Some means should be found to make the training of men on "fire detail" more positive, and some means devised to appraise the effectiveness of the training so that on subsequent fires reliance may not be placed on officers whose training did not "take."

Human psychology is such that we seldom see the self evident, let alone the supporting facts or reasons for things that happen, unless we are trained to do so. We are largely creatures of fixed habits—in thinking as well as in doing, and our thinking is not always coordinated with our doing. That is why the expression, "Don't do as I do, but do as I say," is so frequently heard. In our fire-suppression work, for example, there is a wide spread between what is known about fire behavior and the essentials of efficient line construction and the corralling of fires, and putting such knowledge into practice. Much of the difficulty lies in the thinking and habits of fire fighters trained in the school of experience who continue to do things as they first saw them done or learned to do them on the line, rather than to question, experiment, or adapt methods to the needs of each particular fire. Every fire fighter will assert that every fire is different, and yet isn't it true that fundamentally fires are fought the same in New England, on the Pacific coast, in the South, and throughout the Lake States? The technique boiled down is to get a gang of men, give them a line, shovels, hoes or rakes, and a few axes and set them to throwing dirt or digging trenches.

## Foremanship

The officer who is to direct fire-suppression crews must first of all be a good foreman, a leader, and handler of men. Knowledge of, or ability in fire-suppression technique will not compensate for lack of leadership. In fact, a good foreman who knows nothing of fire fighting except generalities will get more done on the fire line than will a technical expert on fire who cannot handle a crew. On a fire line, however, is no place to train men in foremanship. An axiom on a fire is that "if a subordinate can't handle the crew, replace him at once."

The Service may be accused of not training its men in foremanship in the past. Now, however, forest officers can take advantage of the training programs in the C. C. C. and E. R. A.

Does foremanship on the fire line involve anything different from foremanship anywhere else? Is foremanship important enough to receive special consideration in training for suppression work?

## Knowledge of Organization

The basic essentials of good organization of fire-suppression forces are pretty well known, and it is not difficult to impart this knowledge to new officers. The trouble comes in getting the trainee to understand and appreciate how the members of such an organization should function. As a part of the presuppression effort splendid work has been done in instructing field officers in planning and organizing fire-suppression forces. Check lists of duties have been made for the various jobs in an organization. Perhaps the inexperienced officer needs to know what to do with his organization after he gets it; how to make it function effectively in the suppression of fires. He needs to be trained in analyzing his organization and in trouble shooting when it is in action so as to be able to correct weak spots before major breaks occur.

## Organizing Ability

The trainee must have certain innate qualifications or aptitudes before he can be trained to organize, direct, and correlate the work of fire crews. This is largely a matter of executive ability which may be developed by administrative work not connected with fire. The problem in this case is one of training an otherwise competent officer in the application of the principles of leadership to fire-suppression work. If the trainee lacks executive ability, the start must be made from scratch, and a long period of apprenticeship training in administrative principles and their application is involved. In either case, the most difficult part is the development of the trainee's judgment, because this makes up a large part of the skill of an officer in any form of executive work. The trainee must have not only an adequate basis of fact or knowledge, but also must be experienced (practiced) in the correct use and application of that knowledge until he is efficient in organizing, directing, and correlating the work of fire crews.

## Mobilization and Demobilization

Mobilizing and demobilizing fire organizations can be considered as a mechanical process for the service of supply. When, where, and how, is largely a matter of administrative decision for the fire chief. Both phases require administrative skill and judgment, and what has been said before would apply equally here.

## Recognizing Potentialities

Someone has said that, "If our foresight were as good as our hindsight, we'd all be better off by a damn sight." An nowhere is this truer than on bad fires. The highest type of skill is required to foresee serious situations before they arise and to plan the attack so as to meet the trouble adequately when it comes. Ability to do this can be developed only where the trainee has been given all the basic training and experience essential to the job and is then trained in the critical use of that skill as a fire strategist.

Development of the capacity to recognize and appraise potentialities and ability to marshal fire suppression resources so as to meet such exigencies as occur is the final step in building officers for command of suppression forces. It can be accomplished only by a careful build-up of the officers concerned over a long period of training in which experience on fires intelligently analyzed and applied forms the primary factor of instruction. Matters of regional policy and the opinions and judgments of inspecting officers all affect the training problem. There must be a uniform understanding or interpretation of regional policy; men must be taught not to go to extremes. Inspecting officers must get all the facts and must distinguish between their opinions and their judgments. Whenever comment or criticism by inspectors is not fully explained by facts, the trainee will be further confused and judgments which may have been building up for some time are likely to be vitiated. The inspecting officer at this stage of the development of officers must consciously and conscientiously place himself in the position of an instructor. To do this he may use the facts gained from inspection, but he must use them with the attitude and approach of a trainer, not an inspector.

## Confidence in Action

Most officers are more or less nervous and even panicky when they have to handle their first fire "on their own," regardless of its size. The less experienced the officer, the greater the likelihood that this feeling may seriously interfere with his effectiveness in directing the fire-suppression work. Occasionally officers of considerable experience will "go to pieces" on a fire. Many times it is only temporary; the officer soon "gets his feet on the ground." Training, habit, and discipline assert themselves, and he is able to function effectively in spite of himself. Besides inexperience, the physical condition of the officer, a combination of adverse breaks, not having had a bad fire for a number of years, or any one of a number of causes, including incompetency, may cause him to "blow up." Perhaps there is no

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panacea, no training which will prevent the occasional break from lack of or loss of confidence and the surrender of an officer in command to excitement, pressure, or fear. Training and experience on fires will minimize the chance of going to pieces, but the human element must be considered with all the charity possible when such trouble does occur, even though appropriate action must be taken after all circumstances and results are determined.

## Summary

Summarizing the problem of training overhead for fire-suppression work we find that:

1. There is need for training in certain basic knowledge of fire-suppression work as a foundation.
2. It is necessary to train in the application of that knowledge.
3. The major problem is one of developing confident leadership, supported by well developed administrative ability and sound judgment in the executive and technical work of fire suppression.
4. There are certain limitations beyond which training and experience cannot go.
5. No new training methods are involved.

Perhaps the most vital factor is not only the recognition of the need for training, but also the acceptance of the responsibility for training by those in charge of fire-suppression work. Much of the training necessary can be given only by those "in command." Possibly we need to go back of our overhead failures on fires and check up on the officers under whom the personnel were trained for deficiencies in executive ability and skill in training.

A great spread exists between what is known and what is practiced in corralling, controlling, and mopping up of fires. Part of this is the result of following established habits of work; part is the result of the failure to think. Training to date has been largely concentrated on the "doing" end of suppression work. The training of overhead involves primarily instruction in analytical and critical thinking in fire suppresssion. This is a harder, slower task, because it calls for the conscious guidance of the mental reactions of the trainees. Greater progress will be made when thinking is more closely coordinated with doing in corralling and controlling fires.

# APPLICATION OF PANORAMIC PHOTOGRAPHS IN LOCATING FOREST FIRES

BERNARD H. PAUL

*Assistant in Charge of Intelligence Division, Los Angeles County Department of Forester and Fire Warden*

The fire detection system of Los Angeles County, Calif., consists of 26 lookout stations, 10 of which are operated by the County Department of Forester and Fire Warden, 14 by the United States Forest Service, and 2 under cooperative arrangement. Each of these obser-

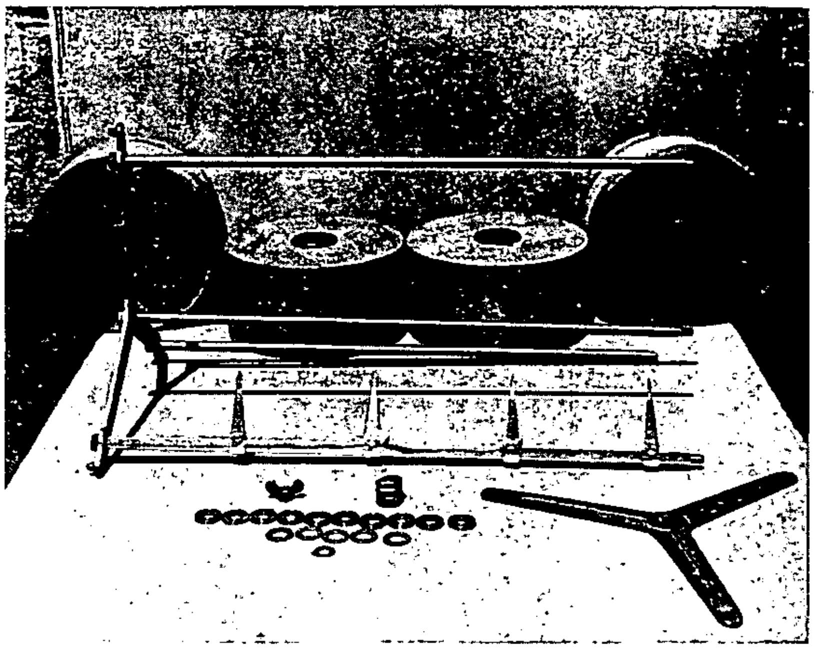
Rotating panoramic photographs being used by dispatcher.

vation units is equipped with an Osborne fire finder, providing both vertical and horizontal angle readings.

Since the ordinary dispatcher's map recognizes application only of the horizontal arc, in order to take full advantage of these instruments it was necessary to devise another method of interpretation. This consists of a rack, or stand, containing panoramic pictures taken from four different towers whose coverages are composite. These photographs, upon each of which is superimposed azimuth circles reading to 30 minutes or arc, are mounted on the periphery of separate drums whose perimeters equal the overall length of the prints. The drums are placed upon a vertical spindle and revolve on ball bearings on a horizontal plane.

One of the three side braces is equipped with four adjustable pointers, one for each drum. Vertical movement of the pointer is directed by a scale giving plus or minus angles from the horizontal.

The operation of the instrument is simple. With the azimuth and vertical angle given by the observer, the dispatcher rotates the drum until the pointer is coincidental with the readings. Familiarity with the terrain is vitally necessary, particularly on those instances where indirect observations occur. Cross-readings, or intersections, are



Component parts of the rotary rack.

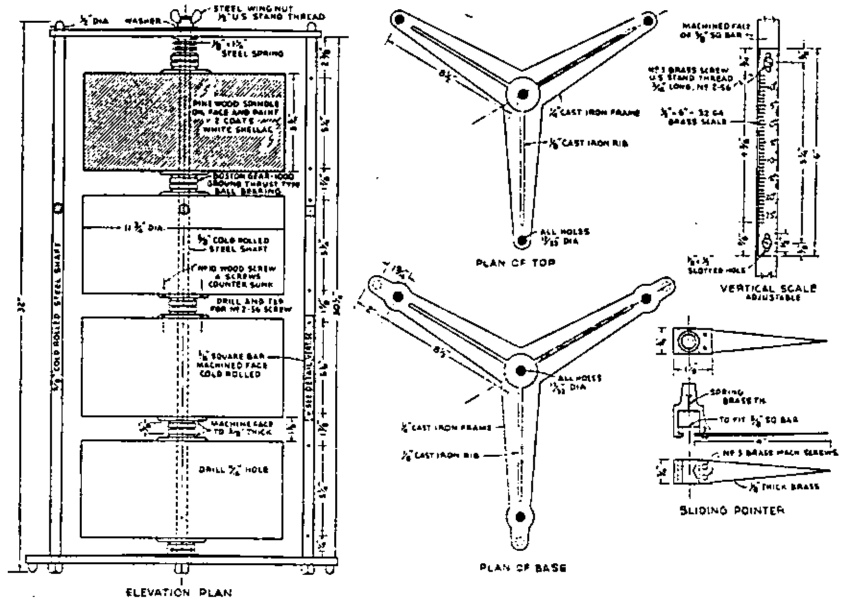
obtained visually from an inspection of the position indicated by the pointer on different drums.

The whole assembly takes up little room and can be placed on the desk within convenient reach of the dispatcher, which obviates the necessity of leaving the phone unattended as in the use of the standard wall map. It also permits operation during conversation with the observer.

The value of this device as a public relation factor is important. The "topog" map, azimuth circles, and strings are somewhat difficult for the layman to comprehend, but he readily understands a photograph, particularly when it depicts country familiar to him. People are attracted by anything that moves, and once the drum is revolved before the inquirer's eyes he is interested and his attention is obtained. Pertinent questions aroused through this medium provide an excellent opportunity for the fire warden to spread the gospel of fire prevention.

The instrument itself consists of two castings, the bottom support and the cap, a central spindle, and three braces. Two or the vertical side rods are cold-rolled steel, and the third is a square bar upon which are fastened the scales and the adjustable pointers. The drums are of seasoned sugar pine with ordinary pipe flanges for hubs and are separated by annular ball races. The pointers are held in place by a friction device consisting of a small coil spring and a ball bearing. A larger coil spring placed between the topmost drum and the bracket exerts sufficient pressure to regulate the turning movement of the drums, as well as to compensate for lateral movement on the spindle. The whole assembly weighs approximately 40 pounds. It can be dismounted quickly and alternate drums may be set in place within a few moments.

A local engineering concern has built a dozen of these rotary fire finders on this department's specifications at a cost of about $30 per unit.




Plan of rotary fire finder using panoramic photographs.

# AN IMPROVISED FIRE-HOSE BRUSH

J. E. Ritter

*Region 7, U. S. Forest Service*

Every fire fighter who has use for and access to power pumps is confronted with a current maintenance job, as well as the annual problem of storage of fire hose.

Even a double-cotton-jacketed, rubber-lined hose or a linen hose of substantial weave is subject to wear if much abrasive material is encountered in the field. Cleaning the hose in preparation for the next fire or for winter storage also subjects it to wear. Some recommend that brushing linen hose in any manner be avoided. Others suggest light brushing to get off the dry mud and dirt.

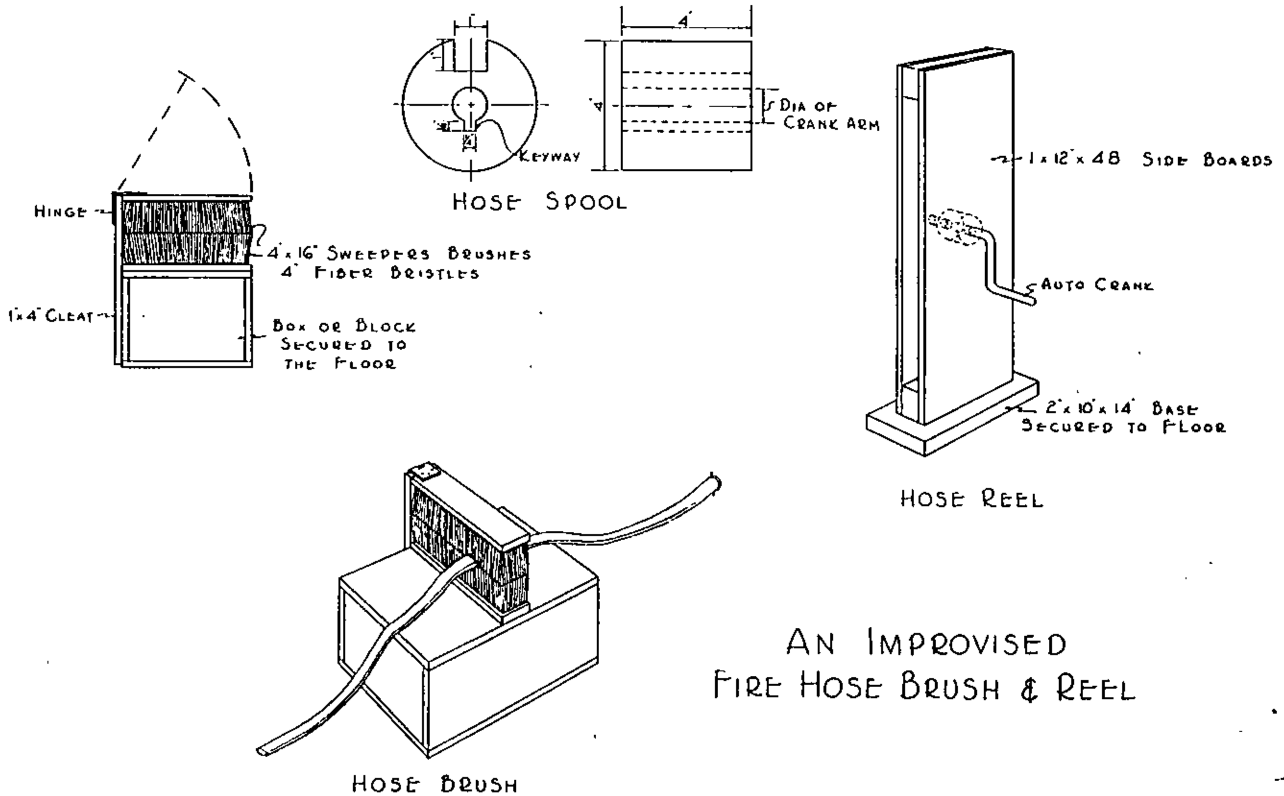
When traveling in New York State last summer I observed a brushing device built by a fire-control man. It was simple, inexpensive, but effective. A homemade hose reel was constructed from a couple of breast-high uprights of 1 by 12-inch material fastened to a base standing on end, spaced a little wider apart than the width of dry hose (1½ inches diameter), through which was inserted an old automobile crank with core to hold a bite of hose preparatory to reeling up the section.

Fastened to a box or stand approximately 2 feet in front of the reel were the heads of two fiber brooms (approximately 4 by 16 inches, with 4-inch fibers), one inverted over the other. The lower one was fastened securely to the stand while the other was hinged so that it might be opened for inserting hose and then closed or tightened with the hand or foot to obtain the desired pressure.

The hose is placed between the fibers of the two brooms in a horizontal position, inserted in the reel and coiled into compact rolls of convenient diameter by merely turning the crank, applying pressure on the brush sufficient to knock off the dirt. If the hose and mud are extremely dry, the mere weight of the brush will be sufficient to take off the dirt with little if any danger of injuring hose threads.

The type of brush used in the hose cleaner was adopted, I understand, merely to utilize materials on hand and to avoid further investment. Many other types of fiber or bristle brushes should be just as effective.

The reel described is most suited for 50-foot lengths of unlined linen hose. The accompanying sketch of the device may be of assistance to others in developing and constructing types of cleaners adaptable to other sizes of hose.



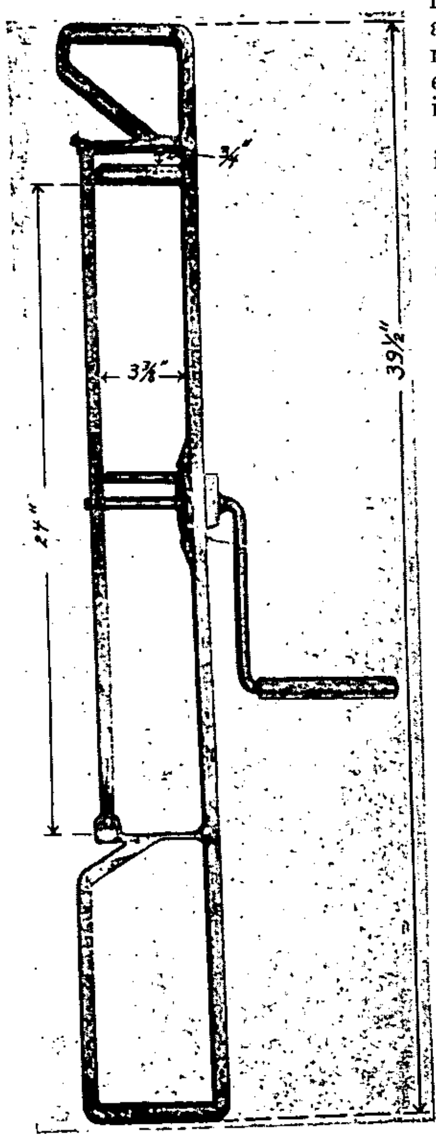

This simple fire-hose brush is inexpensive, but effective.

# PORTABLE HOSE REEL

A. P. Swayne

*Superior National Forest, Region 9, U. S. Forest Service*

Historically, the need for a portable reel to handle marine pump hose was first felt at the Rocky Lake fire on the LaCroix Ranger District of the Superior National Forest during the 1937 fire season. With 5,000 feet of hose to be moved several times, the problem of rolling and laying it out became acute. The remoteness and roughness of the area brought out the necessity for lightness and portability in any reel developed.




Weighing only 7 pounds, this portable reel is so shaped that it will pack readily with any pump-equipment outfit.

The essential features of the reel illustrated are easily understood. A staff, with a hand grip at the top and a stirrup at the bottom, makes up the entire frame. A bearing is set near the middle of the staff with an axle slightly longer than the thickness of the staff. The axle is turned by a crank with a folding handle. On the other end of the axle is the fork. This consists of two tines, of which one is the prolongation of the axle and the other is offset from it about 2 inches and parallel with the first. Their length is equal to the width of the hose when flat. A hinged hose guide that latches in position beyond the fork is the only other part.

In rolling up a length of hose the reel is first set at about the middle of the hose and the hose guide opened. The hose is then laid between the tines, the guide is closed, and by turning the crank the hose is reeled into a compact roll. A groove in the offset tine facilitates tying the roll, and the guide is then opened and the hose may be lifted from the tines ready to be transported. The hose, rolled from the middle, reels in much more rapidly than when rolled from one end. The couplings are on the outside of the roll and may be screwed together a couple of turns to prevent battering of the threads. The rubber gaskets can be left in place without chance of getting lost when this is done. The action of the reel gives hose with water in it a chance to drain from both ends, making it unnecessary to drain hose before rolling for short quick moves, and thereby saving much time.

The weight of the reel is 7 pounds when made of seamless tubing. Its shape lends itself readily to packing with any pump equipment outfit. The illustration shows a model made of channel iron, but the weight of this material makes its use undesirable. The material recommended, and which is being used, is ¾-inch diameter, 18-gage, cold-drawn, seamless tubing.

Use of this reel, by furnishing a quick and easy method of moving hose, should cut down the tendency to drag hose for short moves under the stress of fire conditions. Increase in the life of the hose should be the result.

Past experience in rolling hose by hand and tests with the reel indicate that under fire conditions it will likely be fairly easy to cut the time of picking up hose by 40 percent and stringing it out by 20 percent. Inexperienced C. C. C. enrollees were used for these tests. The tests with dry hose were made on level, cleared ground. The test using wet hose was made on rough ground, following a crooked trail through timber, under conditions similar to a fire trail. The results of the tests follow:

TEST 1. DRY HOSE

| | *Seconds required to roll by hand* | *Seconds required to roll by reel* |
|---|---|---|
| 100 feet linen hose | 90 | 5 |
| | 80 | 10 |
| | 85 | 5 |
| Average | 85 | 7 |
| 50 feet rubber-lined hose | 65 | 5 |
| | 65 | 5 |
| | 65 | 5 |
| Average | 65 | 5 |

TEST 2. WET HOSE (PARTIALLY FULL OF WATER)

(*a*) Time required for one man to uncouple, roll by hand, tie, and sack 3 lengths described above was 10 minutes and 30 seconds.

(*b*) Time required for one man to uncouple, roll from the end with the reel, tie, and sack the same hose as (*a*), about 6 minutes and 30 seconds.

128483—39——3

# ELAPSED TIME CALCULATOR

*Region 1, U. S. Forest Service*

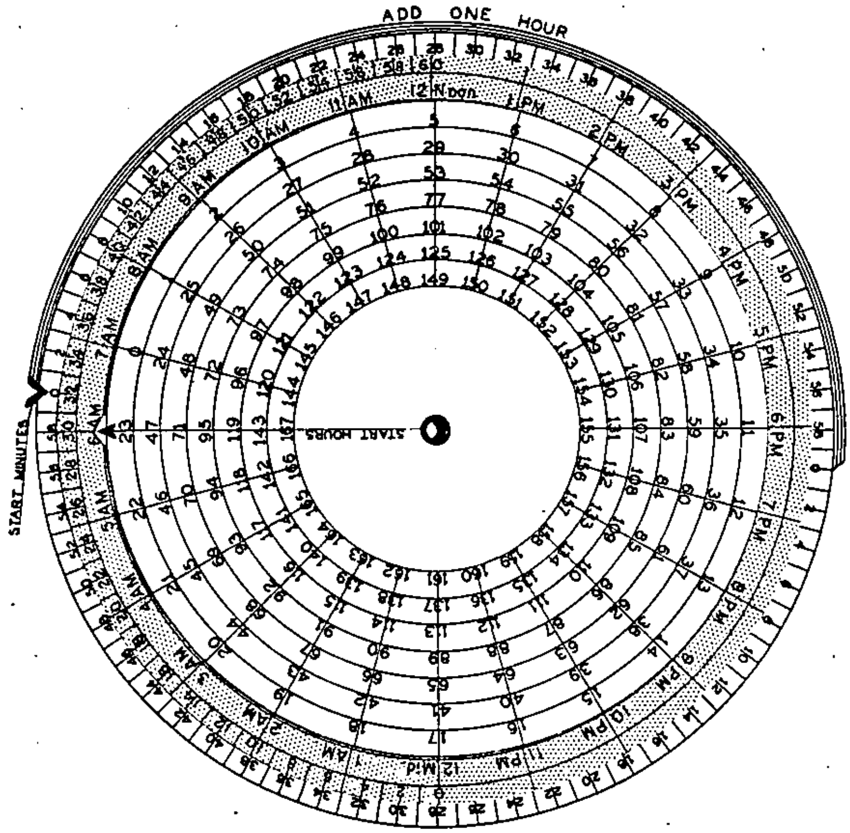
Region 1 saves time and improves accuracy by the use of the 8-by-11½-inch card illustrated. The small and medium dials are attached to the card by a simple brass eyelet. The large dial is printed on the card itself.

The instructions on the card are as follows:

Figures on small circle indicate elapsed time in hours, each succeeding line toward center represents a 24-hour period. Figures on largest circle indicate elapsed time in minutes, upper half represents 1 hour and minutes as indicated.

Figures on middle circle indicate the time of day in hours and minutes.

*Example.*—To calculate elapsed time from 6:32 a. m. July 21 to 4:18 p. m. July 25: Set pointer on small circle at 6 a. m., move both small circle and middle circle until pointer on larger circle is at 32. Then read hours on small circle down 5 places at 4 p. m. we find 105 hours; then read large circle where the figure 18 is located on the middle circle and we find 46, which gives us 105 hours and 46 minutes, total elapsed time.




To determine the number of places to count off on the small circle (from outer row towards the center), determine the exact number of full 24-hour periods between the two time figures and dates used, allowing one place for each full 24-hour period, beginning with the second place of the figure row. If the minute reading on the last date falls in the upper half of the large circle, add 1 hour to the reading in hours shown on the small circle. If the minute reading falls in the lower half of the large circle, use the reading shown on the small circle for the time indicated.

# A FIRE-CONTROL TRAINING MAP

H. B. Rowland

*Project Forester, Farm Security Administration*

Often in connection with fire-control training, it is difficult to put over properly certain phases of the work by explanation, diagram, or other usual methods of presentation. One difficulty is to present a bird's-eye view of the entire fire and the whole process of suppressing it. It would help if we could picture vividly the necessity of concerted and coordinated effort, and the relation of each man's job to every other job and the part they all have in successful accomplishment. Another problem is to visualize the importance of time and quick, accurate judgment. Fake fires and small burnings are of some help, but they have their limitations. Several years ago, the writer, having these problems in mind, developed an animated relief map on which experimental fires could be burned.

At first, a small indoor model 3 feet square was made of asbestos plaster, with a scale of 1 foot to the mile. Since then, a large 10 by 15 foot outdoor model has been built of concrete. The relief maps were taken from a standard topographic sheet. All the usual characteristics are represented, roads, trails, streams, towns, towers, and warden locations. A large visible scale helps as a yardstick.

In use, the map is dusted over with a green inflammable powder made to burn at a given rate of speed. The powder represents the inflammable forest fuel and burns with a slow, creeping, sputtering action without flame.

The powder is a mixture of wood flour and saltpeter, with a dash of chrome green pigment for color. About 23 parts by volume of wood flour and 1 part pulverized saltpeter, thoroughly shaken together, should make the proper mixture, although a little experimenting must be done. A few less parts of wood flour make a "flash" powder and a few more parts make a fuel that is too slow or that will not burn at all. Several types of fuel make variable conditions on the same set-up. All unburned powder can be brushed up for future use.

On a large map several problems may be worked out with one dusting, or the map may be brushed off and repowdered each time. The powder is used about ⅛ inch deep, but variation in amount offers different conditions. The rate of burning is regulated by the mixture used. The speed of burning over the map gives a time scale for all action. In use the passage of time is marked by a timekeeper or large clock face. On the scale suggested, 1 minute represents 1 hour of time.

A small stylus was devised to rake the powder aside as in a raked fire line. The stylus was figured to scale on the basis of a 10-man crew. On the map-scale mentioned, an ordinary pin with the head clipped off set in a small stock or pencil answered the purpose. With such a gadget one can rake line on the map at a rate representing the work of 10 men raking line through ordinary hardwood conditions. One soon becomes tired trying to beat the line scale too much and unless the line is raked correctly and safely the fire usually creeps over.

So far the experiment has been based on the average powder burning normally. A little adjustment of the powder makes fast or slow burning fuel or fuel that will not burn at all. Well dried fuel will burn faster than that at ordinary room conditions. A small electric fan speeds up the fire and a gusty wind may even cause small spot fires to jump ahead, as a mere spark ignites the powder. With all these combinations of wind and fuel, it is possible to simulate almost any fire condition even to a complete "blow-up." Special care must be taken to see that the various scales are correctly worked out.

With a judge, timekeepers, and observers appointed and the conditions explained, other men are selected for fire boss, wardens, towermen, runners, helpers, etc., each man handling his own part. Helpers are sometimes needed to carry out the work of some officer, since the time element is speeded up. A small mimeographed map of the set-up may be of assistance.

A spark or match starts the fire. It spreads in all directions. The fire is discovered and reported, in the proper or designated elapsed time, by the towerman using a small map and alidade. Wardens are called and travel to the fire by elapsed time of distance and time scale. Upon arrival the warden sets to work to surround the fire with a safe line. His stylus keeps him in scale. When the fire reaches his line, it goes out for lack of fuel if the line is safe, or he may backfire with a helper. If the line is not safe, the fire usually creeps over. The break-over is handled only in scale for discovery and travel back and at the expense of the forward line. According to the burning conditions created, the fire may be a simple one-man fire of a few minutes or a many-crew fire of longer duration.

Any changes, additional crews, and the handling by the fire boss must be done according to time schedule for scouting, messages, travel, etc. This often shows quite obviously the exasperating things that happen on a fire because of the changes continually brought about through time. Often it is easy to see on the map immediately what should or could be done to take care of a certain situation then plainly visible—only to see the chance lost as the time element has its play. The map also gives a bird's-eye view of all parts and the simultaneous actions which are taking place on all sides to complete the whole. All work done is left recorded in the ash or dust after the fire is over, which makes possible a detailed review. One may in this way use the device as a problem table, or an instructor may use it alone to demonstrate methods and procedure in handling a fire.

Quite easily and naturally the results of good and poor judgment, delay, confusion, misunderstanding, haste, etc., may be seen. Action may be allowed to follow a natural course, or a situation may be deliberately worked up to a definite problem for individuals to tackle. With a little planning and manipulation actual fires may be reenacted in miniature. Innumerable modifications and adaptations are possible, but the fire actually burns and makes its own problems and must be put out if it is to be stopped.

In this day of intensive training for fire control in Federal and State service and C. C. C. camps, a training map such as that described might be of value to training officers and others. Such maps are quite easily made and inexpensive. They offer possibilities for real action, interest, and instruction, limited only by the imagination and resourcefulness of the directing officer in devising problems and details.

# FUEL FEED SYSTEM FOR FIRE PUMPS

BENJAMIN A. WILEY

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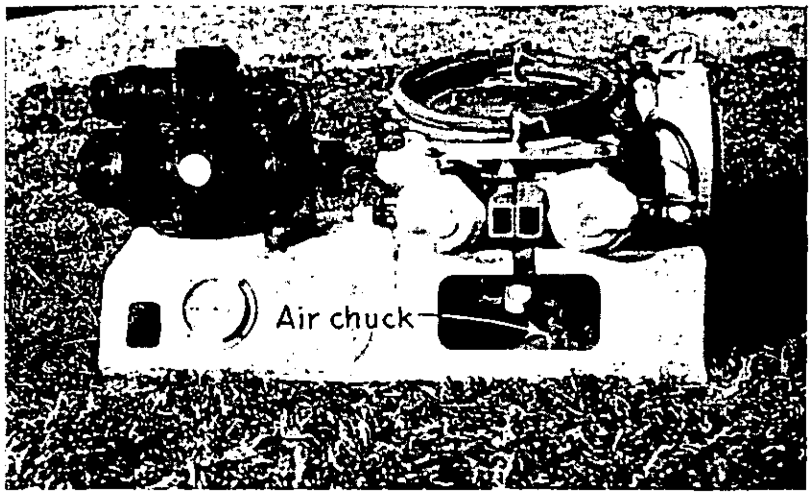
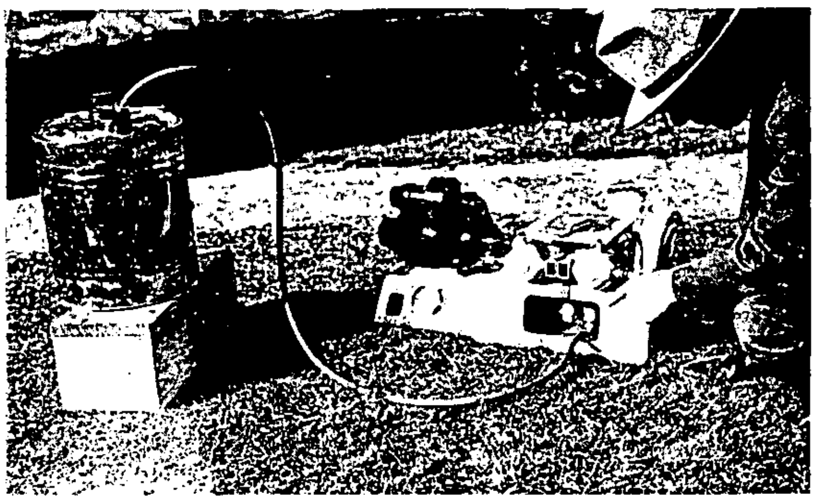
Comprised of: One ¼-inch, red rubber-covered air hose 7 feet long, and one Schrader air-chuck coupling, ¼-inch in size.

Total cost: Approximately $1 for both hose and coupling.

How to construct: Remove present ⅛-inch feed line from settling basin and enlarge hole with ¼-inch drill to take ¼-inch copper pipe. Insert and solder in ¼- by 1½-inch copper pipe. Insert other end of pipe




Fuel-feed unit unassembled for transportation or storage. Note position of air chuck.



Fuel-feed unit assembled for operation showing flexible-rubber air-pump hose attached to air chuck on carburetor feed line.

into the air-chuck coupling and solder in securely. Run ⅛-inch drill through coupling to enlarge passage and to remove any solder which may have entered pipe.

Time required to construct: 10 to 15 minutes.

Designed to eliminate: (1) Clogged fuel feed pipes caused by dried sediment and scale which collects in fuel tanks during periods of nonuse; (2) the soft, easily crushed and leaky gas tank with its attendant fire hazard to the pumper itself; (3) the necessity of stopping the pump every 45 minutes for refueling, thereby saving 1 hour of each fire-fighting day lost in refueling the small tank—this usually hurried

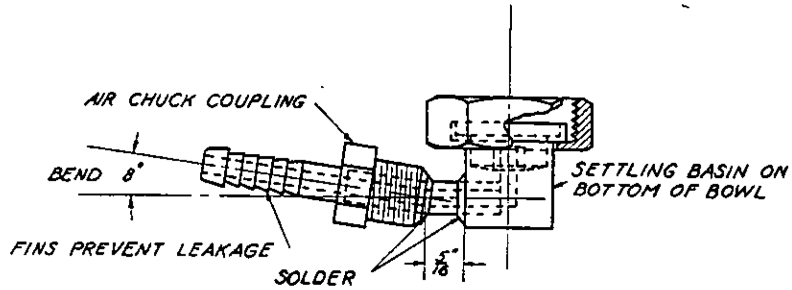



Diagram showing details of fuel-feed system.

refueling often results in overfilled tanks, with more fire hazard, oil-soaked spark-plug wires and magneto parts; (4) the necessity of carrying a funnel.

Provides: (1) An uninterrupted safe fuel supply; (2) a fuel system that can be completely cleaned in 3 minutes.

Tested: (1) By many hours in actual service; (2) hose tested by soaking in gasoline for 200 hours.

Reaction: Hose swells, but not sufficiently to interfere with fuel supply. After removing from gasoline it returns to its original size in a short time.

# METHOD FOR MEASURING PERIMETER OF FIRE

GEORGE M. BYRAM

*Appalachian Forest Experiment Station*

In FIRE CONTROL NOTES for December 6, 1937, J. A. Mitchell described a rule of thumb for computing the rate of spread of a fire in terms of the rate of perimeter increase. According to his rule, the rate of perimeter increase of a fire is equal to approximately 3 times the rate at which the head of a fire is advancing. As Mitchell points out, if a fire spreads at equal rates in all directions, the rate of perimeter increase is $2\pi$ or 6.28 times the radial rate of spread, but since fires burning in a wind tend to spread primarily in one direction, the ratio is more nearly equal to $\pi$, or approximately 3.

A similar method can be used to estimate accurately the perimeter of a fire regardless of its shape. If the boundary of an irregular area $A$,

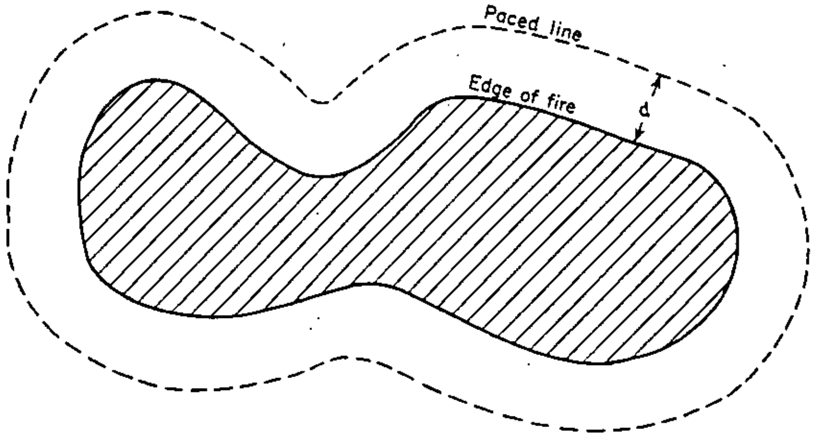



Diagram illustrating method of measuring fire perimeter. The perimeter equals the length of the paced line minus $2\pi d$.

such as that illustrated, is paced so that the pacer always keeps at a constant distance $d$ from the boundary of area $A$, the perimeter of $A$ will be equal to the distance traveled by the pacer minus $2\pi d$, or approximately $6d$. For instance, if the pacer always traveled at a distance of 30 feet from a burning fire, he would subtract 6 by 30 or 180 feet from the total distance traveled to obtain the correct fire perimeter.

It might appear that this rule would hold only for circular areas, but it can be shown mathematically that it applies to any area regardless of shape. A practical difficulty would be encountered on fires where narrow necks or intrusions had widths less than $2d$. In such cases, if the pacer kept at a distance $d$ from the burning edge, he would be obliged to walk partly within the adjacent burning area. However, this condition probably is seldom encountered in actual practice.

If the fire spreads at an appreciable rate while the pacer is measuring its perimeter, he will not be able to close the curve when he reaches the starting point. However, if he stops opposite the starting point on a line perpendicular to the fire's edge, he will obtain an approximately correct perimeter.

# METHODS OF USING DRIVEN WELL POINTS FOR FIRE-SUPPRESSION PURPOSES

L. J. Ashbaugh

*Assistant Forester, Upper Michigan National Forest*

The use of driven well points to obtain water is known to many men who are concerned with the suppression of forest fires. Their use is quite limited, however, depending upon the nature of soils and the depth to water-bearing levels. Where a large percentage of the area in which fires occur is in swampland or sandy, rock-free highlands, having relatively high water tables, well points can be used to very good advantage. They can be driven to depths of 30 or 40 feet under optimum conditions. Ordinarily 10 to 20 feet is more within the driving range in swampy areas because of the high water table.

The methods described here have been used on the Upper Michigan with good success.

## The Well-Point Driver

A well-point driver is necessary in order to quickly and efficiently drive pipe to required depths. Two men can drive pipe without loss of time with the driver shown in figure 1 in the illustration.

In using the driver the following points should be noted:

1. Always cap the driven pipe to avoid punching a hole in the babbitt, to give larger striking surface, and to avoid injury to threads of pipe being driven.
2. Pipe lengths should not be cut longer than 6 feet.
3. Pipe joints should be leaded to eliminate suction. In the field a bar of brown laundry soap used on the joints is sufficient.

The well-point driver is of relatively simple construction. The cap should be acetylene welded to avoid its being punched out by the force concentrated on it during driving. Holes are drilled through the pipe at the points indicated in the drawing to take the ¾-inch tool-steel handle. The handle should have a snug fit. The babbitt will hold it in place.

## Use of Single Well Points

Well points should be 3½ or 4 feet long; 60-mesh screen is usually considered best for all purposes; 1¼-inch points are in general use.

Single points may be driven and a standard well or a pitcher pump attached. The pitcher pump is most desirable where the water table is high, because of ease in handling and attaching it. This type of driven well is of most value for filling water and pump cans where water is not available nearby or must be hauled long distances.

## Use of Multiple Well Points

Two or more points can be driven for use with a power-pump unit and will supply a steady flow of water for use in mopping up hot lines.

In order to draw from as large an area as possible the points should be located 8 or 10 feet apart. This will take better advantage of

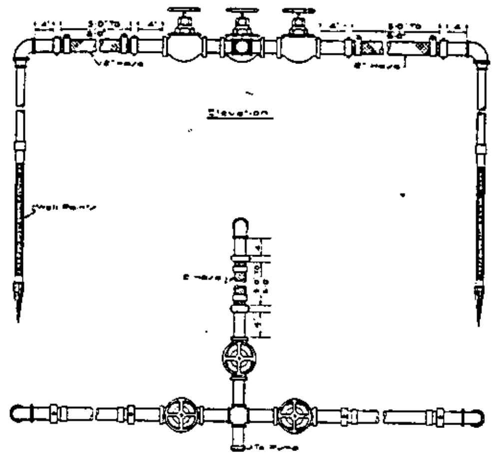


FIGURE NO. 2

Multiple Well Point Connection for Fairbanks Morse or similar type Pumps

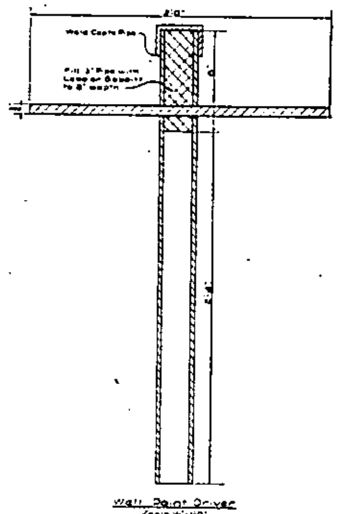



FIGURE NO. 1

BILL OF MATERIALS

FOR FIGURE NO. 2

[illegible]

FOR FIGURE NO. 1

[illegible]

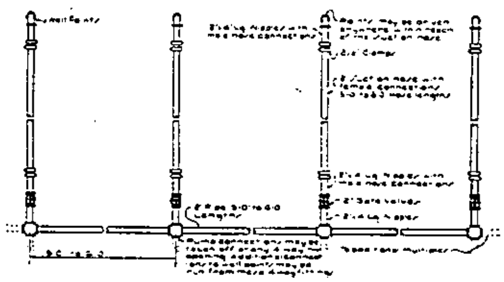


FIGURE NO. 3

Shows method of connecting multiple well points in series

water bearing levels, and also avoid bunching equipment and men at work. While a second point is being driven the first may be rigged and attached to the pumper.

Where flexible intake suction hose is used, it is not necessary to drive the well points in line. Also, it is not necessary that the pipes extend equal distances above the ground. The only requirement is that the distance between the points be within the limit to which the couplings and suction hose are cut and can be extended.

In driving individual points, a cone-shaped hole should be dug at the point of driving. Water can then be poured alongside the driven point to eliminate sucking of air when the pump is put in operation.

When a multiple unit is set up, all joints should be leaded. A bar of brown laundry soap will serve the same purpose in the field.

Use of a four-way coupling with nipples makes it possible to hook directly as shown in figure 2 of the illustration, the fourth connection being the pump intake. If gate valves are also used it is possible to cut out any or all well points. One point may then be put in use while another is being sunk, or a point which is sucking air may be cut out.

If T's are substituted for elbows directly on the take-off from any one individual point, an additional extension can be made to another point 8 or 10 feet distant.

From the point of take-off at the well point, 2-inch piping, couplings, and valves are used.

The four-way connection with valves attached may be set up with leaded joints as may also the 2-inch suction hose units with female swivel couplings attached. Elbows or T's with nipples attached may similarly be prepared in advance.

Upon driving the point it is merely necessary to attach the elbow with nipple and reducer attached. The suction hose with swivel couplings is then attached to the nipple, the other coupling being ready to attach to a four-way valve unit. As other points are sunk, they are in turn coupled to the four-way valve unit. The pump, also attached to the four-way valve unit, may be placed in operation as soon as sufficient points have been connected to furnish an adequate water supply. Points may be cut in or out at will by use of the valves.

As will be noted from a study of figure 2 in the sketch, two points may be anywhere up to about 12 feet apart, while the third may be about 6 feet to the rear of the center point of the line connecting the first two. This gives an ideal spacing. If more points are sunk, they may be extended beyond the first points to distances governed by equipment available, topography, etc. The flexibility of the intake hose permits selection of well-point locations as governed by physical features of the ground, rocks, stumps, etc. While the suction hose lengths of 5 feet, as shown in the sketch, together with couplings, increases the total length to around 6 feet, it is permissible to have somewhat longer or shorter connections. The lengths may be increased by 2 or 3 feet, but should not be shortened to less than 4 feet because of the difficulty in bending short lengths of suction hose.

Figure 3 of the illustration shows a method of hooking up multiple well points, using a main-line pipe and four-way couplings. It will be noted from a study of this sketch that points may be driven on either side of the main line, the only governing factor being the length of the suction hose couplings. Points may be placed all on one side of the main-line pipe, on both sides, or at selected points on either side. Similar latitude is allowed in the selection of the pump location, which may be at either end of the main-line pipe or at any one of the four-way connections. It will naturally be placed so as to be nearest the largest group of working points.

Flexibility is one advantage of the unit, and allows points to be sunk at almost any location. The units are designed in multiples which may be changed, added, or removed at will or cut off by use of gate valves or plugs. Four-way connections with valves attached should be kept intact and assembled at all times if possible. The suction hose with swivel couplings is very convenient, inasmuch as it can be quickly attached with the use of only a spanner wrench. Rubber washers eliminate the need of soap or white lead when attaching hose to the pipe or nipples.

## Power Pump and Engine

Fast motors, cooled by circulating water from the intake, are not adaptable to this type of hook-up because of their high speed. Any great variation of water flowing through their cooling systems would soon cause them to burn out. Pacific marine or Evinrude motors are, therefore, not adaptable to this form of use. Instead a slower motor, with self-contained water cooling system is used.

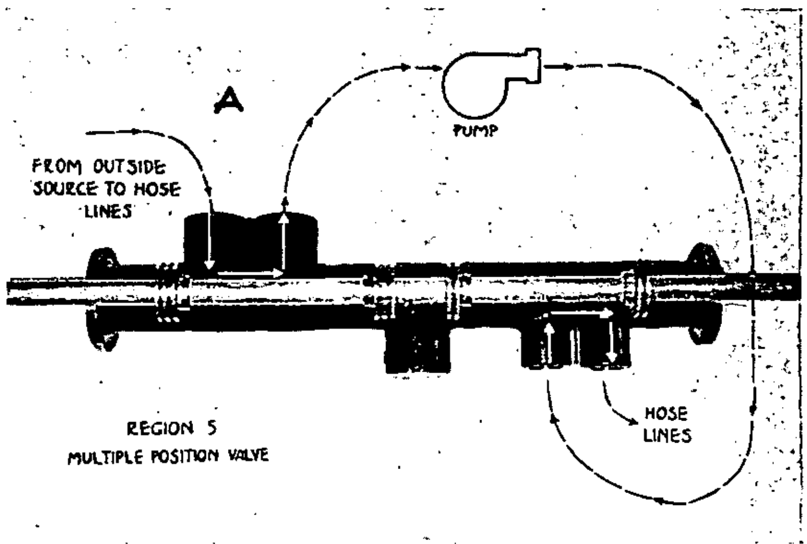
The Fairbanks-Morse type of pump with simple gasoline engine attached has been used very successfully. Other similar types of motors are doubtless available, although we have not had experience with them. The one used does not demand such a constant or heavy flow of water, and a temporary lag or halt in the water stream in no way harms the motor, which is cooled by its own water supply. The use of 2-inch intake suction hose for connectives between well points permits easy flexibility without buckling because of the vacuum created by the pump.

# THE MULTIPLE-POSITION VALVE

F. W. Funke

*Fire Equipment Specialist, Region 5, U. S. Forest Service*

There has long been a definite need for a quicker and easier operating valve-control manifold for use on tank trucks, not so much because of the time element involved in operating a set of valves, but because of the value of simplicity in the use of such a device. The training of tank truck operators becomes much simpler when the various pumping system-control operations are reduced to a minimum, and the possi-




bility of failure in critical situations because of complicated valve systems is greatly lessened.

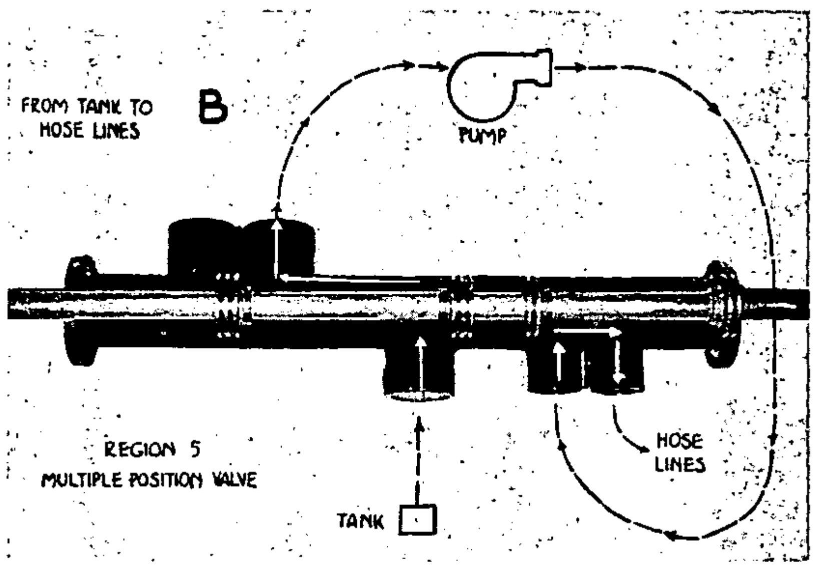
In order to introduce the necessary flexibility in a tank truck piping system, various control valves are required. Including the feature of drafting from either side of the tanker a minimum of five individually operated valves in units of this type are necessary for the delivery of water from an outside source to the hose lines, from an outside source to the tank, and from the tank to the hose lines.

Although gate valves are acceptable on the suction side of the pump, plug type valves must be used on the pressure side. Quality and size of this equipment make the cost rather high. The plug valves must have ample waterway area and be of the high-pressure type with a rating of not less than 350 pounds hydraulic.

Some development has occurred in multipurpose manifolds during the past decade. The State of California Division of Forestry developed a built-up pipe section bypass manifold to reduce piping requirements on various types of tank trucks. The Cleveland National Forest in Region 5 developed a three-way valve adapted from the Merco-Nordstrom valve and used it on a number of their tank trucks with success. While investigating the Cleveland development, looking toward its adoption as a regional standard tanker valve installation, certain remediable deficiencies became evident. The result of the investigation was the development of the multiple-position valve illustrated.

While the various valve and piping arrangements included in multipurpose installations have served a very definite purpose, practically all have included in their design various features which restrict their usefulness in tank-truck systems. Constricted waterways and a multiplicity of L's and bends are usual.

When the fact that a 1½-inch, 90-degree elbow is equivalent in friction loss to 8 feet of 1½-inch pipe is considered, it is easy to see where a relatively high loss can be introduced in the system unless

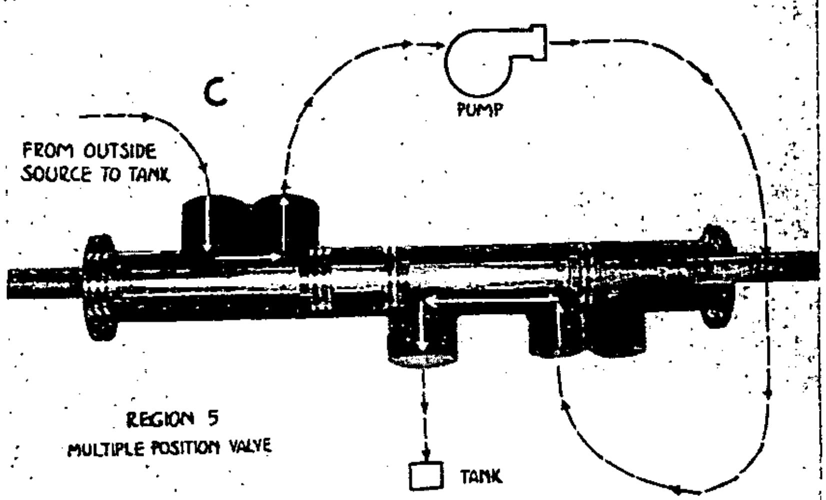



care is used in laying out the pipe lines. Using the theoretical friction-loss factor of 0.11 pound per square foot for 1½-inch smooth iron pipe, it can be assumed that each 90-degree elbow will create 0.88 pound per square inch friction loss. It is obvious that much of the power of the pump can be wasted in the piping system unless care is used to reduce L's and returns to a minimum.

The development illustrated consists of a cast-brass valve body and a conventional piston and rod arrangement. As illustrated the piston valve has been superimposed on the valve body to indicate the arrangement and type of valve. The valve body consists of a tube having a 3-inch diameter bore with three 2½-inch openings and two 1½-inch openings. The piston valve consists of a length of 1¼-inch brass pipe, on which are suitably placed several pistons equipped with Monel-metal rings. The valve body contains webs over the various openings to hold the rings in place while passing over the orifices. Water seal and lubrication is provided through an alemite fitting attached to one end of the piston rod and outlet holes to the ring grooves. Flanges on the ends of the valve body proved a suitable means of mounting the casting for machining and later mounting in the truck chassis.

*A*, *B*, and *C* in the illustration show the relative position of the piston valve for the various operations. These should be quite clear from the schematic outline.

The unit assembly is mounted crosswise in the chassis and is operated either by means of a lever and segment, which provides for three stops indicating the position of the piston, or a hand wheel and screw attached to the piston rod which actuates the valve rod. A suitable indicator plate shows the position of the valve (not shown).




The device requires a valve body 34 inches long; the size of any particular unit is dependent upon the relative size of the openings and waterways.

The ends of the valve body should be packed after mounting with a small plate and a dustproof felt to prevent road dust from entering the bearing surfaces.

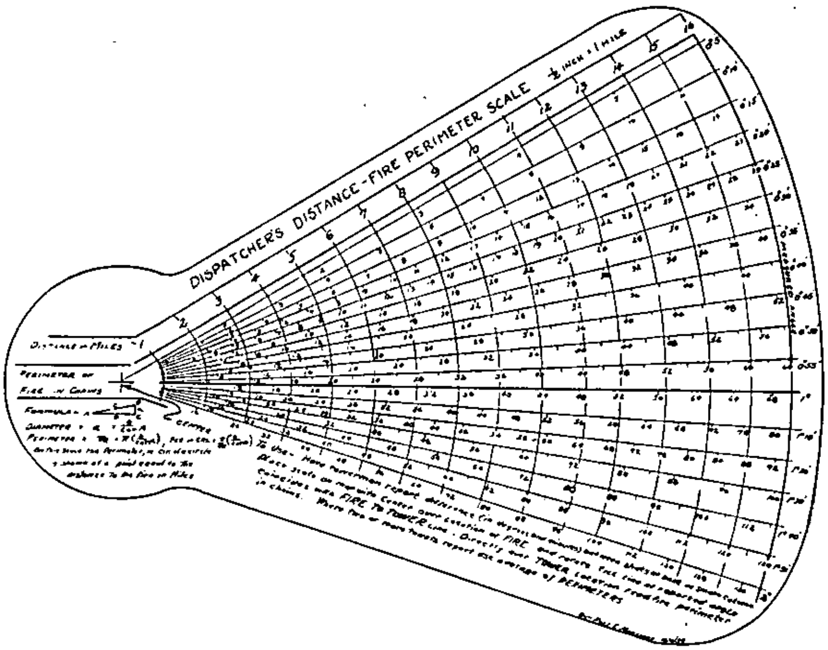
Shop detail blueprints of the device may be obtained by addressing the Regional Forester, United States Forest Service, Phelan Building, San Francisco, Calif. United States Forest Service agencies may make arrangement with the supply depot for purchase of the device. Such units will be furnished with unfinished piston rod ends, which can be cut to the individual installation.

# A DISPATCHER'S DISTANCE-FIRE PERIMETER SCALE

Karl E. Moessner, *Junior Forester, Upper Michigan National Forest, Region 9, U. S. Forest Service*

A dispatcher, mobilizing his forces in the heat of an emergency; an inspector analyst, carefully reviewing the action on an extra-period fire; a research worker, attempting to determine the rate of spread for a given fuel type, all are vitally interested in the size of fires when first discovered by the lookout.

A glance at the fire reports serves to convince the most optimistic individual that our present methods of estimating the initial size of




Distance fire-perimeter scale.

fires are, to say the least, extremely inconsistent. On some forests the measurement of the smoke column by means of mil-scale glasses has tended to improve these estimates, but in most cases the personal opinion of the lookout, backed occasionally by a rule of thumb, has been entered on the reports without check or question.

It is undoubtedly true that an experienced lookout can estimate the size of a fire observed in seen area close to his tower within an allowable limit of error. It is also true that any lookout equipped with fire finder can measure the width of the smoke column, assume a diameter of 90 feet to the mile per degree, multiply the resulting figure by 3.1416, divide by the number of feet in a chain, and arrive eventually at an estimate of the perimeter of the fire.

The lookout can do this, but does he? The figures on our fire reports would seem to indicate that he does not.

The dispatcher's distance-fire perimeter scale illustrated is offered as a means of standardizing the estimates of initial fire perimeters, in order to aid both dispatching and analyzing. It is constructed on transparent plastacel, with a glass-topped pin fixed at the point marked center. It consists of:

1. A distance scale graduated in miles and identical to the scale of the dispatcher's azimuth map (½ inch=1 mile, where this scale map is used).

2. A number of scales placed below this, but radiating from a common center, and graduated in chains of perimeter for fires located at varying distances from the observer, and with smoke columns subtended by angles of 5-minute variation.

We find, then, that a fire 9 miles distant, with a smoke column subtending an angle of 20 minutes would have approximately 13 chains perimeter, if of circular form.[1]

In constructing this scale, the following formula is used:

$$\frac{\Pi}{C}\times\frac{b}{\cot A}$$

$\Pi=3.1416$, the circular constant.
$C=66$, the number of feet in a chain.
$b=$the map distance from tower to the fire.
$\cot A=$cotangent of the angle subtended by the smoke column.

In using this scale, the dispatcher:

1. Secures from the lookouts the normal azimuth readings, and the angle subtended by the smoke column, measured to the nearest 5 minutes.

2. Plots the cross shots in the usual way. He then sticks the perimeter scale center pin at the map location of the fire, rotates the scale until the line of the angle read intersects the map location of the tower.

3. Directly below this point he reads the perimeter of the fire in chains.

4. When smoke column readings are obtained from two or more lookouts, the same procedure is followed, except that the final perimeters are averaged.

Where a glass-topped table is used by the dispatcher, it will be found advisable to make up the perimeter scale with a center pin the same size as the protractor. The scale is then used by placing the center pin in a tower hole and rotating it until the angle line intersects the map location of the fire. It will be noted, however, that where two towers submit readings, this method of using the scale requires two set-ups against one for the system previously mentioned.

While it is realized that this scale will not prove absolutely accurate in all cases, it is believed that by concentrating the responsibility for the estimation in the hands of the dispatcher, and furnishing him a tool for the job, much inconsistency in the records will be eliminated.

[1] Records show that most fires in their early stages are circular or oval, tending to become irregular as they increase in size.

# MODIFICATIONS OF THE CALIFORNIA PROFILING BOARD

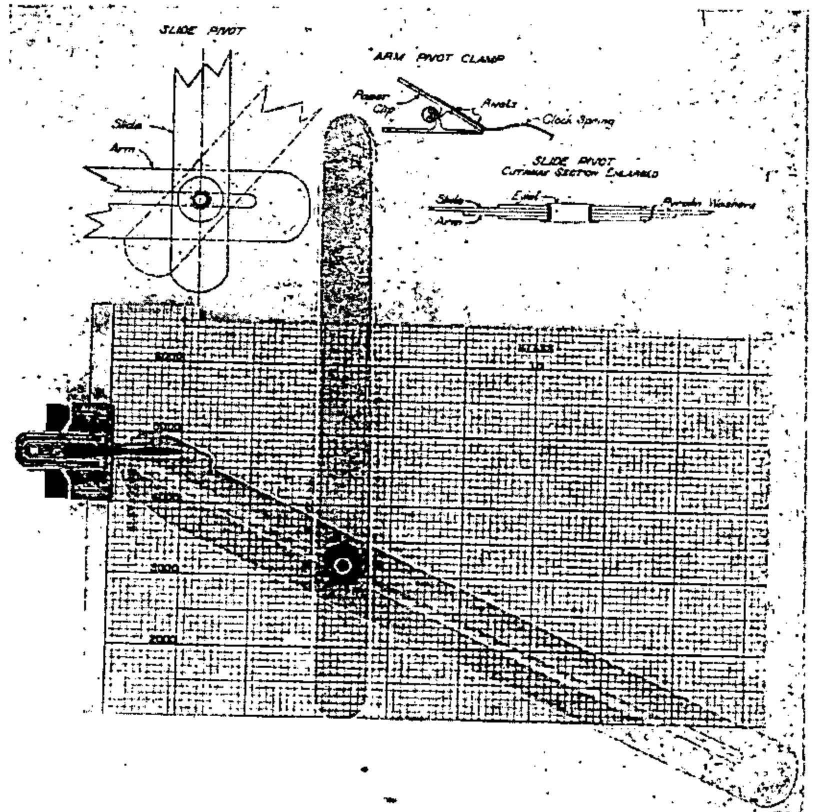
Brooke R. Davis

*Junior Forester, Cherokee National Forest*

The modifications of the California Profiling Board [2] herein described and illustrated consist of an arm-pivot clamp and a slide secured to the arm by means of a movable pivot.

When two points, differing but 50 or 100 feet in elevation, are to be mapped with the profiling board, it is often difficult to pierce the board at the exact elevation desired without breaking over into a previously used arm pivot hole. The arm-pivot clamp is not only very easily and quickly placed on the exact point desired, but also obviates the necessity of piercing holes in the profiling board.

To make an arm-pivot clamp, flatten the sides of a number 10 Esterbrook paper clip; then rivet a small section of clock spring or other resilient metal to the side of the clip, as indicated in the diagram.




Arm-pivot clamp and slide pivot for profiling board.

[2] Described p. 7, U. S. Department of Agriculture Circular No. 449, "Planning, Constructing, and Operating, Forest-fire Lookout Systems in California", by Show, Kotok, Gowen, Curry, and Brown.

The parts of a pivoted slide are all made of pyralin and of any size that is best suited to the scale of the map in use. Before crimping the eyelet with eyelet pliers, it is suggested that a piece of paper be inserted on the inside of each washer and then removed after the eyelet has been crimped, thus insuring ample clearance to allow for freedom of movement of the pivot on the arm.

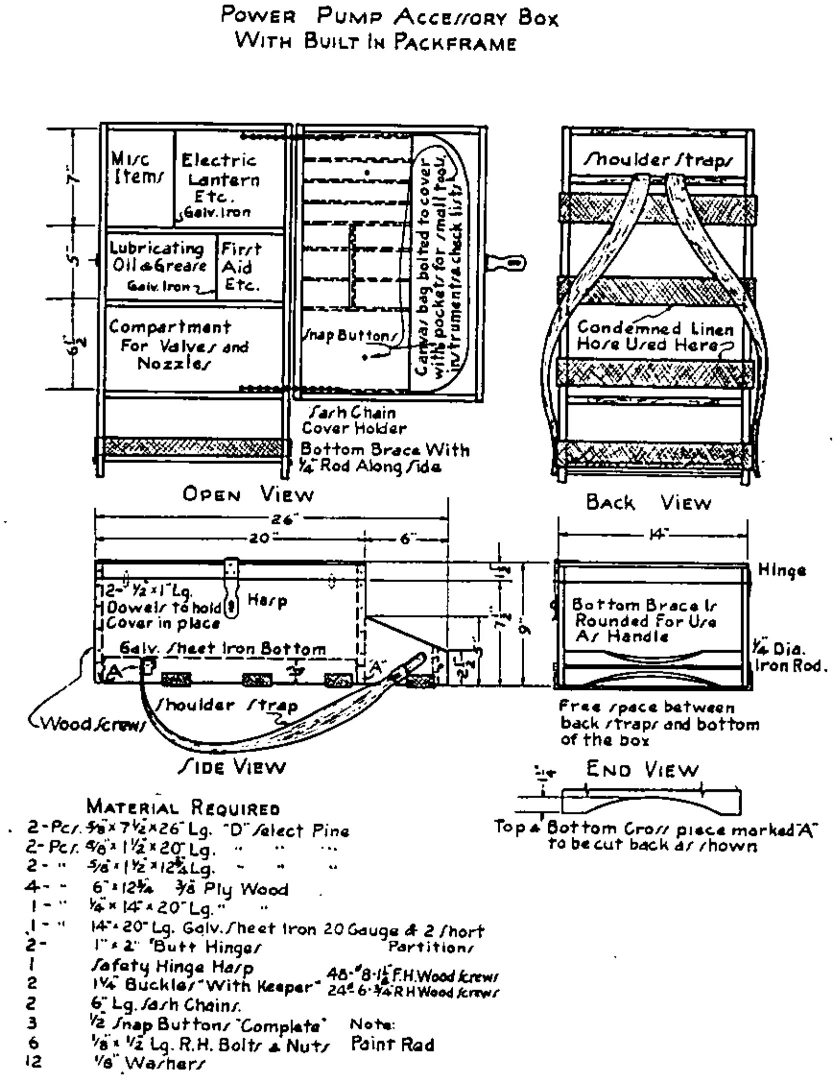
For accuracy, efficiency, and ease in profiling, some form of perpendicular slide is obviously necessary. The pivoted slide described has proved to be exceptionally convenient to handle and of very material aid.

# POWER PUMP ACCESSORY BOX


R. G. Settergren

*Superior National Forest, Region 9, U. S. Forest Service*


The need for an accessory box for the power pumps on the Superior National Forest has long been felt. The packsack was formerly used for the accessories and tools, but was not very satisfactory as the equipment was always in disorder, making it necessary to remove



nearly everything in order to find what was wanted. Usually after every fire there was loss of tools and damage to the accessories because of the method of packing and lack of accountability.

During the last 2 years I have seen several types of accessory boxes and have made two or three of my own, but none of these boxes has proved entirely satisfactory. We have now developed, with the aid and suggestions of the supervisor and regional office, a combination accessory box and pack frame. We believe this will be entirely satisfactory for proper packing of accessories and tools, inasmuch as partitions in the box and canvas tool kit will keep all equipment in an orderly manner, readily accessible, and easily accountable, as each piece of equipment has a designated place.

The box weighs 16 pounds when constructed as shown on the accompanying sketch. The sides and ends are made of "D" select pine finished to ⅝-inch thickness and 8 inches wide. The bottom of the box is made of 28-gage galvanized iron recessed 2 inches to give clearance for the back in packing. The cover and two partitions in the box are made of 3-ply, ⅜-inch plywood with the short partition of 20-gage galvanized iron. The galvanized iron partitions are readily removable as they are slotted in by making a cut with a hack saw about 3/16 of an inch deep. The box is put together entirely with screws, using 1½-inch No. 8 flat-head screws for the box and ⅝-inch No. 8 screws for the cover. The two plywood partitions are nailed in as is the bottom, cleats being used to recess the bottom.

The size of the box itself is 14 by 20 inches, outside measurements, but it was necessary to extend the two side boards 6 inches in order to get ample length on the pack frame. The sketch shows that one end and the brace between the two tailpieces are rounded 1½ inches in order to give back clearance. The brace is rounded on the top for a hand grip while moving around in the warehouse. This is further strengthened by a ¼-inch rod, as shown in the sketch, so the brace will not have a tendency to pull out when the box is carried in the hand.

The tool kit is made of 12-ounce duck, slots sewn for each individual tool, a flap covering the tools, either tied or snapped to hold the tools in place while in transit. This kit is firmly bolted to the cover by six stove bolts.

Condemned 1½-inch linen fire hose tautly stretched and firmly secured with ⅜-inch screws makes a very acceptable back support on the pack frame. Four pieces of this hose spaced 3 inches apart are sufficient, as it is not necessary to have any on the top, as the frame does not rest on the back. The shoulder straps are made of 2-inch webbing secured 6 inches from the top of the frame with leather straps and buckle, for adjustment at the bottom.

One important feature in the design of the box and the attachment of the carrying straps was to get the correct balance to give ease in carrying. After several trials and tests it was found that the load (or box of tools) should be set so it will rest high on the frame when carried. This accounts for the peculiar shape and design of the unit.

The accessories for the power pumps possibly vary between forests and regions, but we have tried to limit the accessories and tools to a minimum so as to reduce weight. The total weight of the accessory box fully equipped is 60 pounds. Following is a list of tools we feel are needed and which can be packed in the box:

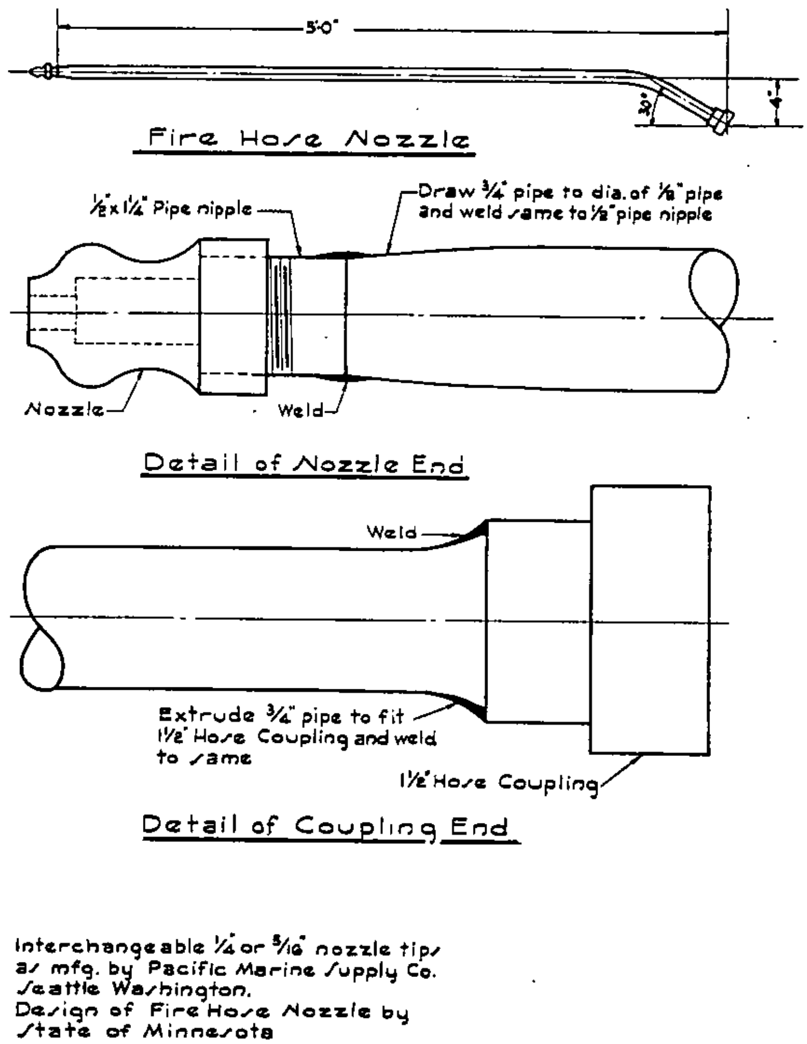
1 cost operation book.
1 crescent wrench.
1 electric lantern.
1 funnel, filtering.
1 file, magneto.
1 first-aid packet SDO.
1 gas-line hose, flexible rubber.
1 grease cup, 1-pound can.
20 hose gaskets.
1 instruction for operation.
1 lubricating oil, in 1-quart can with inverted spout.
2 nozzles.
1 pencil.
1 packing nut wrench.
1 pliers, 6-inch auto.
1 pack cover, canvas, 3 by 3 feet.
1 screw driver, 4-inch.
3 spanner wrenches.
2 spark plugs, extra.
2 Siamese valve couplings.
1 suction hose (strapped on outside of box).
1 suction hose strainer.
2 starting cords.
1 stovepipe wire (small coil).
4 car seals.
1 wiping rag (bundle).
1 copy list of contents.

The list will fit into the pocket on cover or can be tacked on the cover if preferred.

# LONG FIRE-HOSE NOZZLE

*Ottawa National Forest, Region 9, U. S. Forest Service*

The accompanying illustration shows a long fire-hose nozzle for use with 1½-inch hose. This nozzle has proved very valuable for use on deep burning peat fires or for mop up of fires in roots or other deep materials. It was developed by members of the Minnesota State Division of Forestry, and several forests in Region 9 have adopted it as part of their pumper equipment.



**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 technology may flow to and from every worker in the field of forest fire control.