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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 10 Number 1

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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FEEDING FIGHTERS ON THE FIRE LINE

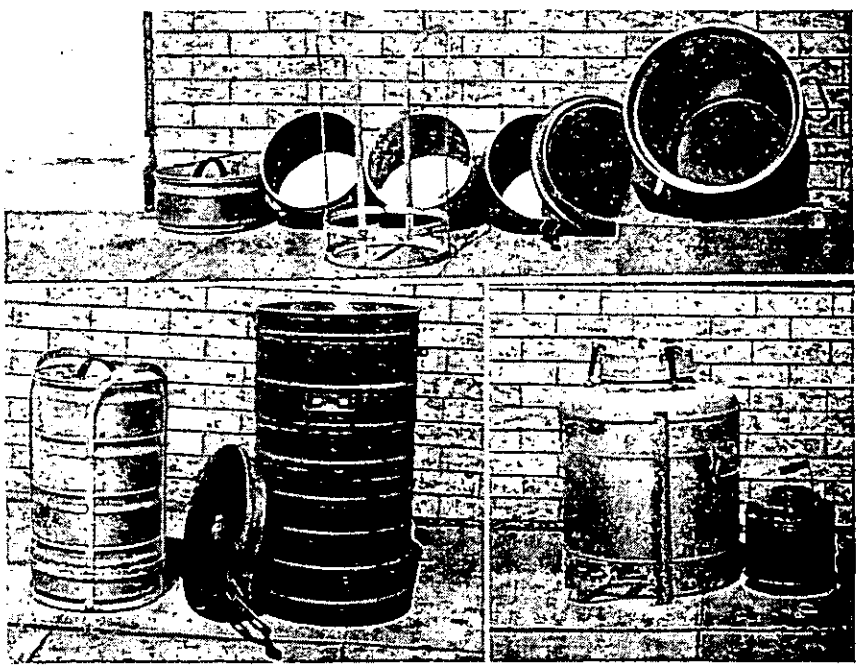
R. H. Blood

Administrative Assistant, Cleveland National Forest

For some time we have felt the need of some method of messing in fire camps that would avoid the long tiresome trek into camp for men who had spent long hours in suppression work; the turmoil and confusion that exists in camp where several hundred men are resting, eating, or changing shifts; the garbage disposal problem; the transportation from headquarters of heavy camp equipment and food supplies; chronic difficulties with cooks and kitchen help; heavy losses of perishables, due to lack of proper refrigeration; etc.

This season we decided to run an experiment during our guard school, in which men could be furnished hot food on the fire line. They could then stay in their assigned locations day and night without returning to camp for food or rest periods.

Through the local military we obtained considerable information on the method employed in feeding field groups during the war and during manuevers. From Camp Pendleton we borrowed 10 Aer-



Food carrier with utensils separated; utensils assembled and ready to be placed in carrier; and the 10-gallon and 1-gallon thermos jugs for liquids.

Void food carriers, which are, in effect, thermos cans containing 4 trays or utensils approximately 11½ inches wide by 6 inches deep. The outside measurements of a can are 27 by 14½ inches, and the total weight empty is 52½ pounds.

These cans will hold food for approximately 50 men and the manufacturer recommends that food be placed in the containers at approximately 180°, and liquids at 200°. The 4 utensils are prepared to handle separately meat, potatoes, a vegetable, and gravy. We had hoped to try a much smaller unit, sufficient to serve 10 to 15 men, but were unable to obtain these from Camp Pendelton. However, there are such utensils on the market. The same is true of the coffee thermos. The type used was 10-gallon size, from which 1-gallon thermos jugs were filled. We are trying now to locate a 5-gallon size.

For the guard training set-up we had a total of 80 men and Fire Control Officer Stevenson desired to feed these in groups of 10 on the fire line. With the larger cans, this made it necessary to reduce the potential capacity of each container by about 80 percent, which had the effect of decreasing the period during which food in the master container would remain hot.

We obtained prices from a local caterer covering dinners of chopped steak, hamburger steak, roast beef, Swiss steak, etc., with mashed potatoes, a green vegetable, and cake. Coffee, as stated, was furnished in 10-gallon urns and distributed to the individual crews in 1-gallon jugs. The breakfast menus included sausage and eggs, bacon and eggs, or ham and eggs, with potatoes, rolls, butter, and coffee. The lunch was an ordinary box lunch containing meat and jam sandwiches and could be obtained with cold milk, handled in the same manner as coffee. The prices asked for these meals were $1 for dinner, 75 cents for breakfast, and 60 cents for lunch.

For experimental purposes, on the second day of guard school, we delivered breakfasts to the camp at approximately 7 a. m., and in the same load sent the lunches and supper for that night. The evening meal, with coffee, was served some 12 hours after preparation and at that time was sufficiently hot. With smaller containers, or with larger crews that would permit the filling of each utensil to capacity, food would remain hot for even a longer period.

Fire Control Officer Stevenson reports as follows on the fire line feeding: "The guard training program included considerable actual line construction and the 80-man crew was broken down into small groups with crew bosses or sector bosses and instructed to remain at their assignments until relieved. Food was delivered to the end of the road in thermos containers. These containers along with knives and forks, paper cups, plates and spoons, and a small thermos of coffee or milk were delivered by pickup or weasel to the various crew leaders. Each crew boss served his own men and within 5 minutes the 80 men had been served. They had finished eating within 25 minutes. Everyone was completely satisfied with quantity and quality of food.

"A base camp was established for the sole purpose of providing a distributing point for tools and food. Camp overhead was reduced to the absolute minimum and no time was lost in bringing men into camp for meals. One man in a jeep or weasel can deliver food to a great number of men that would ordinarily have to be walked to and from

the fire line, or fed exclusively on box lunches. When the camp broke up there was no kitchen equipment to dismantle or clean, no dishes to wash except knives and forks, no garbage to dispose of, and no waste of surplus perishables. The overhead is given an opportunity to get closer to their men by feeding them and by remaining with them throughout the entire period of their employment. On an actual fire, of course, the helicopter should do an excellent job in delivering these canned meals to the men on the line.

"In future, two small units will be set up in the main camp site for heating food that is left over and to provide hot water for washing knives and forks. The latter items are the only draw-back to the operation and we will try to work out a system so that the men will not have to carry their own cutlery."

On July 1 our Pamo Hot Shot Crew was organized and sent to camp. After arrival it was found that neither the stove nor the refrigerator would operate. Repairs would take several hours. Under these conditions, we would ordinarily have to bring the 40 men back to town for food. Instead we sent from here one can containing hot supper and another with breakfast for the following morning.

On July 8, 1948, the Barrett Dam, the Rollin Hills, and Viejas No. 3 fires broke out on the Descanso district and over 4,000 hot meals were served by the method outlined above. Meals were transported 45 miles from San Diego by truck and the men were served on the line, about 20 percent of the deliveries being made by helicopter. In many cases the food had to be delivered in the 1-gallon paper containers recently received, because the master containers were too large for serving the crews of 8 to 10 men spotted at various locations on the line.

It is felt also that the regular meals should be supplemented by cold juices (grapefruit or orange juice) which can also be delivered to the line in thermos containers. We will continue to use milk with lunches, preferably in pint or half-pint paper containers. These containers can also be stored and kept cold in one of the large 10-gallon thermos. To the hot meal we plan to add a cold vegetable salad which can be kept cold either in one of the containers or in a paper carton prepared for that purpose by the Polar Ice Co.

Here in the office we find that at the end of three large fires on which several hundred men were employed our vouchering for food supplies can all be cleaned up in a matter of hours instead of the previous long-drawn-out job of rounding up purchase orders, invoices, etc., from the dozen or more grocery and meat firms. An equal amount of time was saved, of course, in not having to phone in and confirm orders to the large number of grocery stores and meat markets that we are forced to purchase from when fires occur at night or over week-ends. Without having any definite figures to go on, I would say that our actual meal costs, considering regular kitchen help, and other items, has been reduced by something like 50 percent through this method. The intangible savings are impossible to compute.

Food for 500 men, with coffee, milk, and juices, can be handled easily in the bed of an ordinary pickup.

CINDER HILLS—A SPECIAL FIRE CONTROL PROBLEM

K. O. Wilson

Fire Control Officer, Coconino National Forest

Within the northeast corner of the Coconino National Forest lies an area roughly three townships in size which is locally known as the "cinder hills." It is composed of rolling hills over which a layer of black cinders was deposited some 900 years ago by numerous volcanic cones within the area. The cinder particles average about the size of peas, are very porous, and form a layer a few inches to several feet deep. Ground cover is composed chiefly of scattered ponderosa pine, a few grasses where the cinder deposit is thin, and a sparse growth of shrubs on the north slopes. The area is characterized by patches of barren cinders which form an irregular pattern among the trees. These patches vary in width from a few inches to several hundred feet.

Until recent years these cinder hills have been cataloged as "too scattered to log," and what little logging was done on the area was confined to small tracts which supported the heavier stands. Recent heavy demands on the lumber market have caused this area to be logged rather extensively which has resulted in large areas of almost perennial slash. We use the word "perennial" because the slash deteriorates very slowly because of an almost total absence of moisture-retaining qualities in this type of formation. Extremely high surface temperatures coupled with a high infiltration rate cause moisture to disappear almost as rapidly as it falls. High burning conditions are often in evidence only a few hours after a heavy rain. Add to this a high lightning occurrence, gale force winds, and a high risk from tourists, wood haulers, and loggers, and you have a set of conditions which a fire control officer sees only in his worst nightmares.

On a windy day a fire once started in this area quickly reaches uncontrollable proportions. To put a corral line around a fire in cinders is a relatively simple operation (two RD–6 bulldozers built over 7 miles of line around a large fire this spring in less than 3 hours). To hold the fire within this line is quite another matter. Each fire follows a definite pattern, i. e., the first 24 hours the flashy fuel goes; then the fire starts to dig in. The dead windfalls and stumps are usually consumed within the first 48 hours. After the stumps are gone the fire then starts down each individual root in the root system. The porous nature of the cinders allows enough air into the ground to permit the roots to smoulder very slowly. A fire in 1947 was still burning 62 days after it started. This spring a similar fire started on the 7th of April and was still burning on the 15th of May. A burned area may go several days without showing any sign of smoke and then suddenly on a windy day be smoking in many places.

The obvious question is: "Why don't you put the fire out just like you would any other fire?" This would indeed be a tough assignment. In the first place the nearest water supply is 25 miles away, a prohibitive distance to haul. In the second place there is no mineral soil, except the cinders with which to work. In the third place, after the first 48 hours the fire has gone underground and is extremely difficult to find.

The past two seasons we have been experimenting with various techniques of control, some with disastrous results, and others with varying degrees of success. First we tried just building a control line, allowing the fuel within the line to burn undisturbed, maintaining a patrol until the fire was declared out. This fire had to be patrolled for over 2 months. The next fire we used bulldozers to bury all burning heavy fuel within 100 feet of the line under 3 or 4 feet of cinders. This proved disastrous. The fuel continued to burn, allowing the cinders to fall into the cavities resulting from the consumed fuel, and 12 days after this fire started it suddenly came to life on a windy day and, after crossing the control line in a number of places, more than doubled its original size in one afternoon.

Two valuable lessons were learned from these two experiments. The first, don't let the fire go underground, and the second, cover fuel with cinders only to prevent the wind from spotting in the daytime and uncover at night, allowing the fuel to burn as much as possible.

After the "cover-up" method failed, resulting in a serious break-over, we used an entirely different technique developed from the lessons learned on the first two trials. As soon as the bulldozers had completed the control line we immediately put them to work pushing all heavy fuel at least 300 feet back into the fire from the fire line, and rooting out all of the burning stumps within the same strip before the fire had time to go underground. This was accomplished with three bulldozers within 36 hours after the fire was corraled. In the meantime mop-up crews were patrolling the fire line and the cleared strip, picking up what the bulldozers missed. Other patrol crews were covering a quarter-mile strip outside of the fire line and picked up several small spots. Still other crews were working inside of the cleaned bulldozer strip, digging out stumps and chopping the fire from burning logs.

Seven days after the large break-over we have just described occurred, a strong wind caused the fire to make another break and burn an additional 60 acres. We employed the same technique on this smaller break that we had used on the larger, except that we covered the entire area with bulldozer mop-up, rooting out every stump within the area. This proved successful, and the fire was finally declared out 16 days after the last break-over.

An interesting sidelight on this series of fires was the use of Navajo and Hopi Indians recruited from the vast Navajo-Hopi reservation which lies directly north and east of the cinder hills. Many of them saw the smoke from the fires and rode many miles horseback to report in to their villages and trading posts. Some were transported by truck from as far as 200 miles out on the reservation.

We found them to be very well adapted to mop-up work as long as they are supervised by other Indians. Living under fire camp conditions and sleeping on the ground is their normal way of living. Dis-

cipline was excellent. The crews of approximately 20 men each, with Indian leaders, moved almost with the precision of trained soldiers throughout the camp and fire areas. The crew leaders did a remarkable job of keeping the men away from the camp area when they were off shift and moved their men through tools, timekeeping, and the kitchen with a minimum of time and confusion. Their appetites, aggravated by months of lean living, were enormous. They showed a particular fondness for bread and sugar. As soon as a camp boss learns he is going to have Indians to feed he immediately doubles the order on these two items.

We asked the leaders if a small crew of the Indians would be willing to stay with the fire, patrolling and mopping-up until the fire was out. This turned out to be a question of great importance which called for several council fires burning far into the night while the Indians sat cross-legged and blanket-wrapped before deciding who should remain. All accepted the final decision without question.

By using Indians for the long, tedious job of living with these cinder-hills fires until they are out, we are hopeful that we have struck on a solution to the ever-present manpower problem after control.

WEST VIRGINIA EPISODE

S. H. Marsh

Regional Forest Inspector, Division of State and Private Forestry, Region 7, U. S. Forest Service

The day before Christmas jovial hard-hitting Jim Fischer, district forester of the Pocahontas district for the West Virginia Conservation Commission, called in his men, thanked them for a job well done, and told them they could go home for the holidays. It had been raining for several days and Christmas Eve it was "spitting" snow. Everything looked safe and buttoned up for a holiday.

Jim, a newcomer on the district, had planned to gather up his family which was scattered among his kinfolk, and shake down into his new quarters. His assistants all had their own plans and looked forward to a breather, for it had been touch and go for several weeks. They were also looking forward to wild turkey and the accessories that go with Christmas in West Virginia.

It was a happy group. They jokingly recounted some of the tight spots they had gotten into, and out of, successfully or otherwise, kidded the holder of the record for the biggest fire and with ceremony cut off his shirt tail and tacked it up beside the dispatcher's map. Then all went their separate ways, with pride of accomplishment written in every line of their smoke-stained faces. Their record showed they were good. In 1 year they had fought the notoriously "hot" Pocahontas district, a troublesome area for a generation, into second place for low number of fires and area burned.

Christmas day dawned bright and clear, with a whisper of a wind. The next day, December 26, the wind rose almost with the sun and slowly gathered speed till sundown. When it continued through Saturday, December 27, it was enough to arouse the suspicions of Zara Osborne, the chief clerk, who from long experience had learned what even an apparently insignificant wind can do around the hills of West Virginia.

Was that the faint odor of smoke she smelled as she emerged from a store? She decided to find out and dashed to the office to don the radio harness. Bang, bang, bang, the reports came as fast as she could write them down until she had a list of 14 fires. Quickly deciding that this was more than a one-woman job, she spread the alarm and in a matter of minutes by radio and wire she had men racing over the hills to man their stations. The packages piled so unceremoniously on the desk when she arrived in the office remained there until early Sunday morning when all fires were manned and she was relieved.

As State Fire Chief Mullins, District Forester Jim Fischer and District Fire Chief Costilow converged on district headquarters at Logan, their radios sputtered instructions; and as key points were

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manned, information began to come in, at first in a trickle, then in considerable volume. By the time they reached Logan headquarters, the fire pattern and all its implications had begun to unfold and take shape, and it was clear that trouble, plenty of it, was brewing in the four-county "hot spot" of the district centering in Mingo, the seat of a number of bloody mine wars of a generation ago.

It was not a pretty picture. It appeared that everyone with incendiary proclivities in Mingo County had selected this particular time to put them into practice. Smokes were being reported in the most inaccessible and out-of-the-way places. Wayne Shannon and Lyndell Hockman, the Mingo County protectors, with their local crews were hitting the fires hard. But it soon became evident they would need more help and relief crews as they strung out their men and pinned them down on mop-up.

After State Forester Sayers had make a quick survey by plane, calls were sent to neighboring districts for help which promptly rolled in just as Mingo began opening at the seams and the flood of incendiarism slopped over into McDowell, Wyoming, and Logan Counties.

At this point the plight of the protection organization was related to "Scotty" Harris, chief of the law enforcement division, who promptly dispatched 20 officers, led by "Tiny" Stewart (6 feet 4 inches tall), to help round up recalcitrant or reluctant fire fighters and render such other aid as might be needed. The enforcement officers were paired with fire bosses, and the manpower shortage was dissolved in spite of the prevailing holiday reluctance to fight fire. New fires were promptly and adequately manned. Old fires were fought to a finish and mopped up without break-overs.

From his master chart at headquarters, District Forester Fischer knew what crews were on what fires, when they went on duty, when they were due to be relieved, and just who would relieve them, and he saw to it that the relief kept rolling on schedule. Timing was wellnigh perfect and every man was doing his share of the work.

By Wednesday, December 31, the situation was well in hand. Every fire was covered. Those that had not been mopped up were under control. Then it rained and promptly put an end to the fires. The final score was 50 fires that burned a total of 2,600 acres.

Since the protection of West Virginia's forests was undertaken it had always been well nigh impossible to secure a conviction for a fire law violation in Mingo County. But Jim Fischer and his men either did not appreciate the significance or implications of such a tradition or were just not impressed by the historical events leading up to the fires. At any rate, when it became evident that there would be a respite from the fires, the fire bosses and law enforcement officers gathered to piece together the bits of evidence they had picked up and to discuss the next move.

The next day, New Year's, they teamed up again, a forest officer and a law enforcement officer, and began a systematic combing of the Mingo County hollows for more evidence to back up the few leads they had secured. Five or six teams usually converged on a mining camp or village, interviewing every member of each household and everyone they met on the streets or roads. Having thoroughly canvassed one hollow they proceeded to the next one, until all suspected hollows in Mingo County had been covered.

Gradually, evidence began to pile up, and whenever it pointed unmistakably to a suspect, warrants were sworn out, witnesses summoned, and prosecutions began. The score for Mingo was 25 arrests, 25 convictions. Four of the convictions were on felony charges carrying 1 year in jail. A number of cases were still under investigation this spring in Mingo, as well as in the other counties where the same procedure was followed, and other arrests have been made.

Opinions may vary concerning the efficacy of law enforcement as a fire-prevention measure but the record of the following season (spring of 1948) showed a remarkable, almost unbelievable improvement. Fires occurred at a rate of only 0.19 per 1,000 acres protected and the "burned area" reduced to 0.005 percent of the area protected. Apparently some people had learned, or had been persuaded, that "Forest Fires Don't Pay."

STRETCHER CARRIER

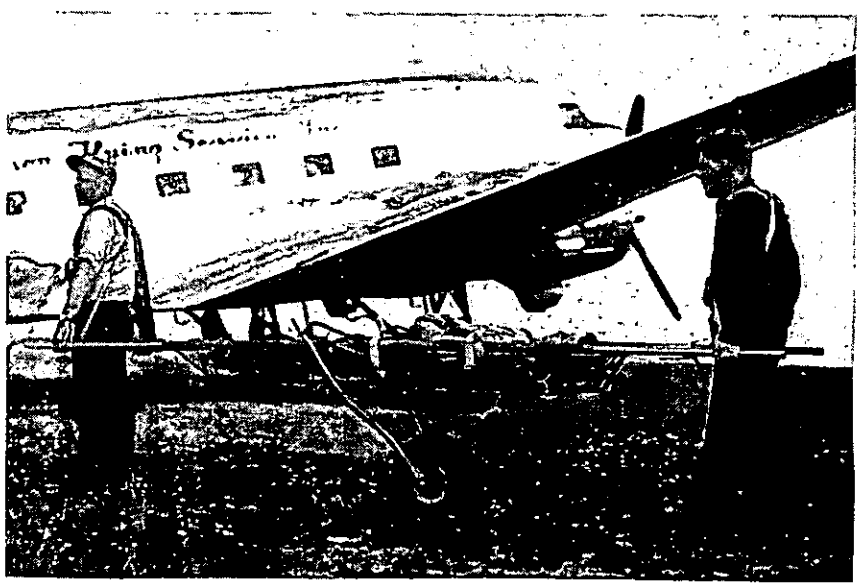
H. K. Harris

Forester, Region 1, U. S. Forest Service

The stretcher carrier has been developed for use of the air rescue squad in Region 1. It requires two men to propel and balance the carrier along trails or in open country.

The patient is carried in a modified Stokes litter, developed by the Army. This litter is supported by a single rubber-tired wheel. The wheel is equipped with a 6.00 by 6 airplane-type tire which has only a few pounds of air. This tire absorbs much of the roughness on rocky trails. The wheel has also been equipped with a brake to retard the carrier on steep slopes. A "wishbone" fork, constructed of aluminum tubing, is hinged on the bottom of the litter and supported by two rings of heavy bungee shock cord. The fork can be adjusted to give proper balance and raise or lower the litter to the best height for ease in handling. A shoulder harness is provided; it is adjustable and has slings made of webbing to carry a large share of the load. Each man uses his arms largely for balance of the carrier. The handles are removable and the carrier folds into a bundle little larger than the Stokes litter. It can be packaged for dropping and assembled for use in a few minutes.

The stretcher carrier was thoroughly tested by members of the air rescue squad, who have had experience in carrying injured men out



to car or plane transportation. The crew took turns riding and pushing over rocks, logs, snow banks, and downhill through dense brush and every form of cover obtainable. They reported the carrier satisfactory. A comparison was made of riding comfort when the stretcher was wheeled over rough rocky trails and when carried over the same trail. Surprisingly the "patient" said it was more comfortable when wheeled over the rocks than when carried.

The carrier has been adopted as part of the regular equipment of our air rescue squad, and is kept ready for immediate use.

Drawings, photographs, and material lists of the carrier are available to other regions or interested agencies. Without the Stokes litter (obtained from the Army) the cost is approximately $75 for materials and labor.

Comparative Performance of D-6 and D-7 Caterpillar Tractors Equipped with Hydraulic Angle Dozers.—E. D. Report No. 13 was issued April 1948. Tests, conducted by the Arcadia Fire Control Equipment Development Center, covered not only work output in constructing fire lines, but also speed of transportation, load limits, etc., which must be taken into consideration in determining the size of tractor best suited to given conditions.

These tests were made primarily for the purpose of comparing performance of the D-6 and D-7 tractors. They were made under ideal conditions, so results approach the maximum rates rather than average. It is believed, however, that the information can be of great value by scaling down anticipated performances in accordance with conditions encountered.

The D-6 tractor compares favorably with the D-7, especially for fire line construction in brush-covered country. However, additional tests in timber country are necessary to complete the comparison. The comparative tests made with the D-6 and the D-7 gave the following results:

1. The D-6 may be transported by truck more rapidly than the D-7, particularly over mountain highways. The saving in time on this type of highway for the D-6 over the D-7 amounted to almost 1 minute per mile, or about 26 percent.

2. Very little difference in speed was observed in walking the two tractors on standard Forest Service truck trails.

3. In grade ability, with the blade raised, there was very little difference between the D-6 and the D-7. It might be well to point out that both tractors have considerably less climbing ability in reverse than in forward gear.

4. There was practically no difference in the cross-country travel performance of the D-6 and D-7 on side slopes with the blade raised.

5. In the construction of fire line through medium and heavy brush and up and down grade, the D-7 produced approximately 20 percent more single pass line on all slopes than the D-6. On a square footage basis, the D-7 constructed 44 percent more fire line per unit time.

In order to produce fire line at the maximum rate, the D-6 and the D-7 should work downhill on grades of 20 percent and over, even though it may be necessary to walk the tractor up the slope to permit downhill construction.

6. When cutting first from one bank and then from the opposite, it was found that, for all practical purposes, greater production was possible by changing angle of blade rather than using a straight blade.

7. In common excavation work the D-7 moved 150 cubic yards per hour while the D-6 moved 111 cubic yards, indicating 35 percent more output for the D-7. (The present D-7 is comparable to the old RD-8, and the D-6 to the old RD-7.)

The D-6 tractor costs less than the D-7 and can be transported faster by truck.

The D-7 tractor constructed per unit of time an average of 20 percent more linear feet of single pass fire line, 44 percent more square feet of fire line, and 48 percent more linear feet of fire line on 30 percent side slope. Its fire line was cleaner on single pass construction; and it excavated 35 percent more cubic yards per unit of time.

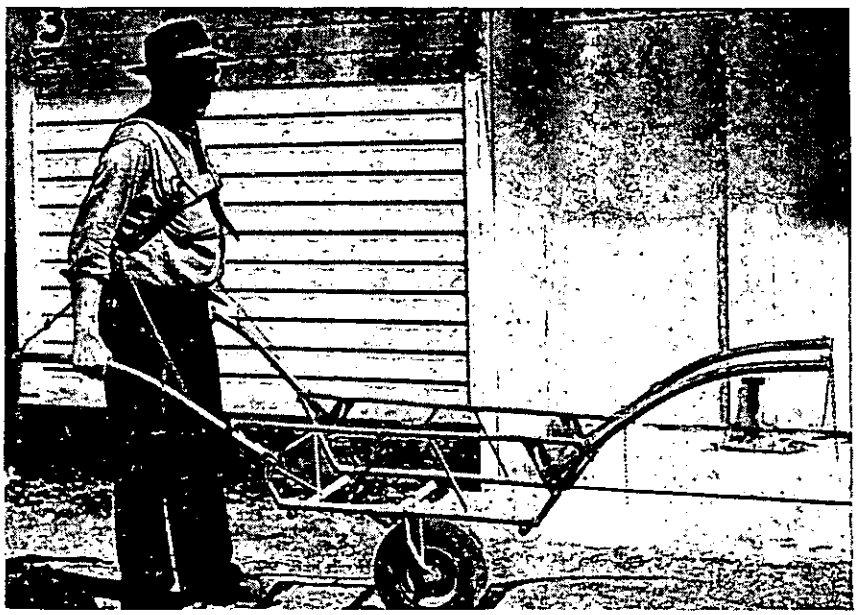
A limited number of copies of E. D. Report No. 13 are available in the Division of Fire Control, Forest Service, Washington, D. C., for distribution to concerns keenly interested in the subject.—Division of Fire Control, *Washington Office, U. S. Forest Service.*

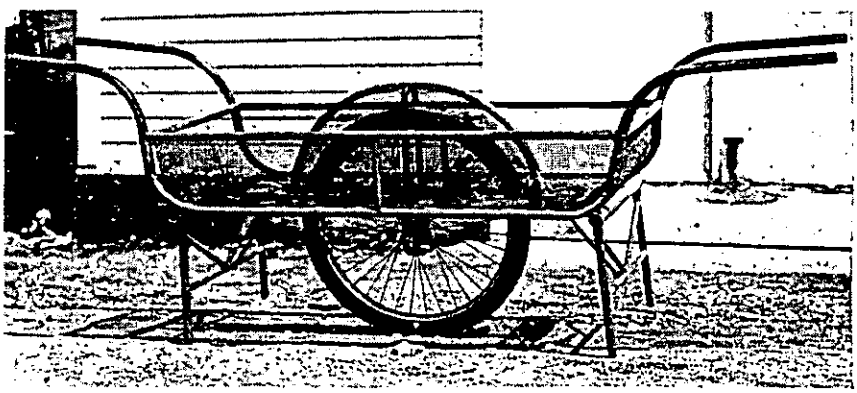
DUFFLE CARRIER

REGION 1

U. S. Forest Service

The duffle carrier is a collapsible, single-wheeled frame for use in transporting equipment along a trail. It is arranged so it can be folded into a compact bundle for dropping by parachute. The carrier weighs 38 pounds and preliminary tests indicate it will carry 150 to 200 pounds.





During the winter, as part of the fire suppression studies, we analyzed the smoke-jumper fires to determine the mileage of cross-country travel and trail travel from the fires to the nearest road or airfield. The difficulties of this travel were also cataloged as uphill, downhill, or level, and averages determined. Our reason for this analysis was to study the problem of returning smoke-jumper equipment by means of Iron Mule or hand-propelled carrier and thus eliminate in certain areas the need to maintain pack stock and pickup men. These studies showed that the duffle carrier has good possibilities.

If an emergency does not exist, equipment in many areas would be returned to road or airfield by the smoke jumpers themselves, even though pick-up by helicopter becomes feasible.

A similar type of duffle carrier has been built for the Bitterroot Forest. Its purpose is to carry a chain saw along trails for maintenance work. Several other forests have also requested a carrier of this type.

Plans for construction of the two carriers illustrated may be obtained from the U. S. Forest Service, Missoula, Mont.

Calcium Chloride Prevents Freezing of Stored Water.—The following tabulation from Marks Mechanical Engineers' Handbook may be of interest to those who have the problem of providing stored water for fire protection at buidings during periods of freezing weather. When 100 pounds of water and solution contain a given weight of calcium chloride the freezing point of the solution is as follows:

Calcium chloride (*pounds*)	*Freezing point* (° F.)	*Calcium chloride* (*pounds*)	*Freezing point* (° F.)
6	28	20	−1.0
8	24.2	22	−7.3
10	21.4	24	−14.1
12	18.2	26	−22.0
14	14.4	28	−32.0
16	9.9	30	−46.0
18	4.7		

If iron barrels are used to contain the water and solution, they should be painted inside with hot tar to prevent deterioration due to the calcium chloride.—Division of Engineering, *Washington Office, U. S. Forest Service.*

A SLIP-ON TANKER FOR PICKUP TRUCKS

H. M. WHITE

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

The unit described and illustrated in this article was designed to fill the need, in the North Pacific Region, for a light slip-on tanker that could be hauled in a one-half-ton pickup or larger truck and quickly removed when the truck was needed for other hauling. The main features of the design are:

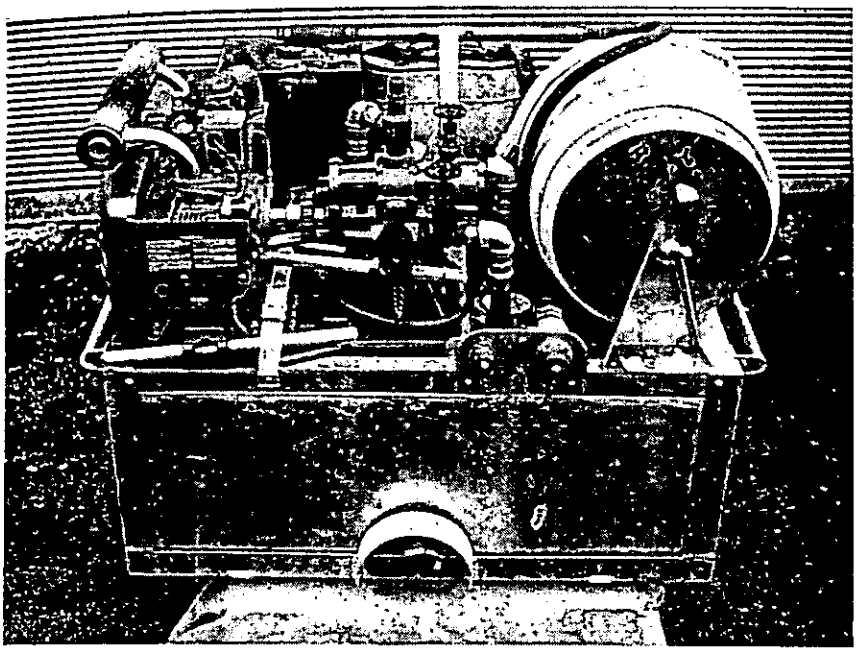
1. The unit is self-contained, the pumper and all accessories being mounted on the top frame.
2. Weight of tank, frame, reel, tool box, piping, and mounting brackets was kept to the minimum by using aluminum alloys. Even the bolts are aluminum.
3. A standard portable pumper, gasoline tank, and suction hose are mounted in such manner that they can be quickly freed for carrying to a water source that may be near a fire but to which the truck cannot be driven.
4. Provision is made for securing the unit in the pickup with clamps attached to the flareboard. The clamps are adjustable for different pickup body widths.
5. One-inch cotton-jacketed rubber-lined discharge hose, rather than rubber hose, is provided to keep the weight down and at the same time permit reasonably high pressure. This hose is carried on a simple reel (dead), because a reel takes less space and is considered more practicable otherwise than a basket for mounting on a small tank. The hose is coupled in three 100-foot lengths, so that if less than the 300 feet provided is needed to reach a fire it will not be necessary to unreel the full amount.

Brief descriptions of the principal parts of the unit are as follows:

Water tank.—Outside dimensions, 46 by 31 by 17 inches, with two baffles across the 31-inch dimension, three 1½-inch drain plugs in the bottom, and a ¾-inch drain cock at rear. Material is No. 52–S aluminum sheet, 0.125 inch thick, except baffles which are 0.092 inch. All joints are welded.

Frame.—Material is No. 61–S extruded aluminum. The sub-frame and corners are 3/16- by 2½- by 2½-inch angle, and the skids ½- by 1½- by 2-inch H-bar. Joints are welded. The top frame is ¼- by 2- by 2-inch channel. It is bolted to the corner uprights so that the tank can be removed for repair or cleaning. The pumper and other things are fastened to the top frame, the handles, reel, tool box, and brackets being bolted.

Reel.—The ends are No. 24–ST aluminum, 15¾ inches in diameter. The shaft is ¾-inch aluminum water pipe, and the core six ⅝-inch No. 24–ST aluminum rods, 22 inches long, set in a 5-inch circle.



Rear view of slip-on tanker in position for sliding into pickup truck.

Tool box and brackets.—These items were made of scraps left over in cutting out the tank. The tool box is 18 by 9 by 4 inches. It carries lugs on top for the fuel tank. Suction hose brackets, at front corners of top frame, are spaced for 4-foot sections of suction hose, and will hold five. A back-pack can is carried in a bracket behind the suction hose. The can and fuel tank are secured with light web straps.

Pumper.—A rotary gear pump, driven by a 10 horsepower, 2-cylinder, 4-cycle, air-cooled engine. Capacity is 35 gallons per minute or more at 250 pounds per square inch. Lugs on the frame keep the pumper from sliding and a heavy web strap holds it down. There is very little vibration. Other kinds of portable pumpers could be used, of course, with some changes in the mounting.

Piping.—To provide for quick detachment, special cross fittings were made, with swivel connections for attachment to pump outlets. Lines to tank and discharge line to outside are made with rubber hose. All metal pipe and fittings, except certain nipples, are aluminum water pipe. To free the pump, the hold-down strap is released and the pump outlet connections uncoupled. The hose from relief valve to tank may be disconnected or left on, as desired. The relief valve is installed in the pump housing. The two gate valves shown control suction and discharge lines to tank, both 1-inch.

Cover.—A waterproofed canvas cover is provided, to fit over the entire unit. It is secured with a draw cord just below the top frame.

Hold-down clamps.—A metal clamp, or wide hook, was made to fit over the roll on the flareboard of the pickup body. It is attached to a 2½-inch heavy web strap, which is passed over the unit handle

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and buckled. Two of these clamps are required. Since the unit is higher than the flareboard on most pickups, the pull is downward. On the Dodge power wagon, arrangements will be made to attach the clamp below the flareboard.

Weight.—The complete unit, dry, with all accessories, weighs approximately 475 pounds; the pumper alone, without fuel tank, 160 pounds.

Cost.—Final figures are not available as yet, but the average cost per unit is expected to approximate $1,200. The pumper, with four 4-foot sections of suction hose, strainer, and necessary tools cost $467.

Detailed plans of this unit are available in the Regional Forester's Office, U. S. Forest Service, Portland, Oreg.

Printing Maps on Fire Finder Disks.—In an effort to improve up the method of mounting paper maps on metal fire finder disks, a procedure has been developed to print maps of any area directly upon the painted surface of any metal disk by the use of a sensitized emulsion containing carbon particles as a pigment. The metal fire finder disks are first cleaned with steel wool or emery cloth then sprayed with 2 coats of flat ice-box white synthetic enamel. When dry, thoroughly sand side of disk to be used with very fine sandpaper. The disk is now coated with the emulsion described below by using the multilith whirler in the same manner as if multilith plates were being coated.

The emulsion is prepared from two solutions. Solution 1 consists of 3 ounces of egg albumen (flake) in 20 ounces of water. This is suspended overnight in a cheesecloth bag and strained. Solution 2 is 1 ounce of ammonium bichromate in 4 ounces of water. Combine solutions 1 and 2 and add strong ammonia water (approximately 28 percent Bohme) until emulsion turns straw yellow. This quantity (20 ounces) of emulsion will coat two disks.

To each 10 ounces of resulting solutions add 1 tube of artists' lampblack water color paste. One teaspoon of Peerless transparent water color will further improve quality of final print. It is important to dissolve pigment thoroughly and then strain emulsion. Also move air bubbles from emulsion by straining through cheesecloth before coating disk in whirler.

A Kodalith film negative is prepared for the area necessary to cover the disk and then exposed with an arc light while in a vacuum frame for a period of approximately 10 minutes. Disks are then immediately washed in water: a piece of cotton is used to clear off excess emulsion not set by light exposure. The background should be clear and white, with map details a good strong black.

When disks are dry, spray 2 coats of clear lacquer on the surface. This will insure resistance to weather and water.

While this process is being used for the first time this season, it is reasonable to believe that this type of print should not fade in sunlight since the pigment coloring is lampblack which is composed of very small carbon particles.—BURTON D. ANDERSON, *Chief Draftsman*, and EARL A. JARBOE, *Supervisor, Duplicating Unit, Region 3, U. S. Forest Service.*

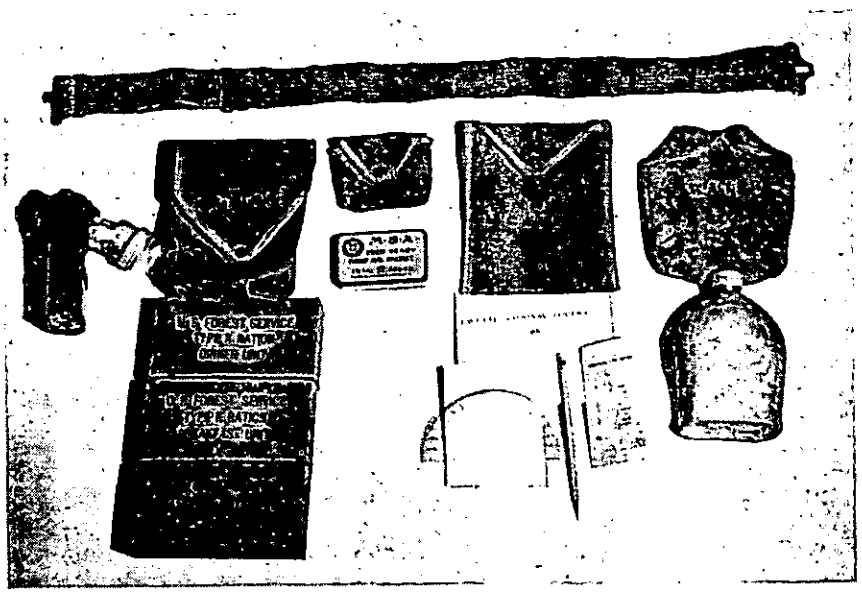
FIRE FIGHTER'S BELT

GLENN A. THOMPSON

Fire Control Staff Officer, Payette National Forest

In central Idaho fire fighters often walk many miles to interior fires without accompanying pack facilities and must carry the means of individual support for a 24-hour period. The equipment for carrying must be the best to allow walking to and fighting a fire. The knapsack has been used for many years but the individual was always forced to leave it whenever he began work.

The fire fighter's belt was selected as an all-purpose carrying device that would permit the individual to be self-sufficient not only during the initial attack period but throughout each work shift thereafter. The smoke jumpers have used these belts for the past year and find that they fit their needs very well.



Fire fighter's belt with packets and items detached. Any combination of these and other items can be quickly assembled.

SOUTH DAKOTA'S JEEP TANKER

HARRY R. WOODWARD

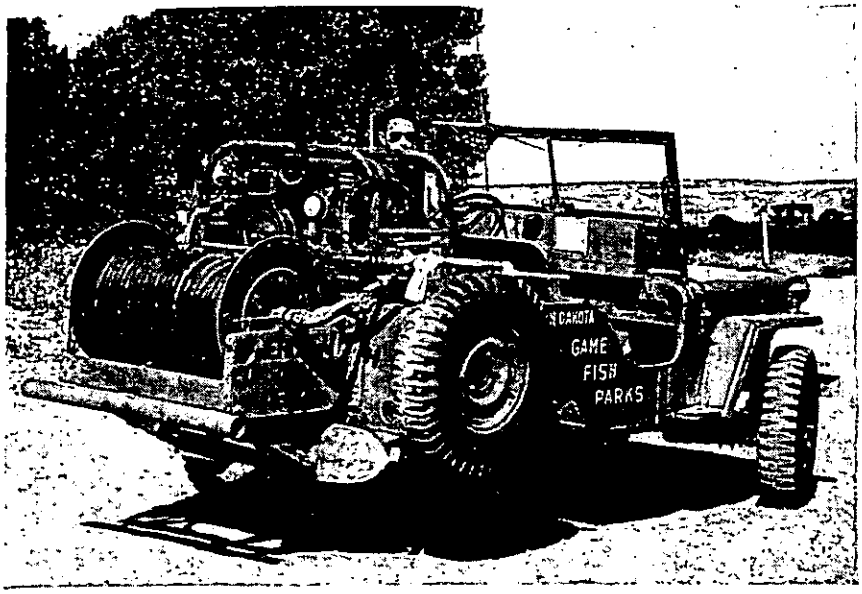
State Forester, South Dakota Department of Game, Fish, and Parks

Since the war many fire control organizations have made various developments in the use of the jeep as a fire fighter. South Dakota has had such excellent success that our particular developments bear some discussion.

In the first place there were no facilities in our organization to provide housing and manpower for jeep units, and yet we knew that if we could get some mobile units strategically located that our fire problem could be largely solved. This speculation resulted in cooperative agreements with various fire departments in the Black Hills area. Under these agreements the State furnishes a jeep equipped with two-way frequency modulation radio to the fire department. In return, the fire department agrees to equip it, house it, maintain it, and go to any fire when called upon by the State. The State reserves the right to approve the type of equipment to be installed.

When the jeeps were requisitioned, it was specified that they be furnished with heavy duty (11-leaf) springs, and 15-inch wheels with 7:00–15 tires to help in carrying additional weight. Also specified were bumper weights to help distribute weight and the hot climate (oversize) radiator to help cool the motor on long tough pulls or long periods of idling. In addition to these features, we installed heavy-duty generators capable of producing 65 amperes at idling speeds. This generator maks it possible to operate the radio over long periods by just keeping the motor idling. A siren and the radio, a 50-watt transmitter, were also installed. The illustration shows a typical installation for the Link radio in a heavy steel box bolted to the body just above the dashboard. Installations on other units include both the Motorola and General Electric types.

The remainder of the equipment was purchased by the fire department, in most cases with county aid. First of all a heavy gage metal tank was custom built to just fit into the box of the jeep. Capacities of these tanks varied from 85 to 100 gallons. On top of the tank a Bean 101–F portable fire fighter was mounted with wing nuts to permit easy removal so that the pump can be used as a separate unit. We prefer a pump with a power unit separate from the jeep motor to give uniform pressures and to permit the development of a high pressure without overworking the power plant. With this type of pump, we found that sustained operating pressures of 400 pounds gave the best results with a minimum of deterioration to equipment. The live reel shown has proven very efficient and is recommended for all jeep tankers. By using a smaller outside diameter hose (not shown here)



Jeep tanker operated cooperatively by the Hermosa Community Volunteer Fire Department and the South Dakota Department of Game, Fish, and Parks.

which has only one braid and yet can withstand high pressures, we found that we could carry almost twice as much hose by length. The trigger-type fog gun is of great importance in water economy.

Other features included in our jeep units are hand tools of which you see a shovel and part of a back-pack pump. A McLeod tool and a Pulaski tool are carried on the left side and are not shown. An injector type tank filling unit enables you to rapidly fill the tank from a pond or stream. The maximum output of this pump is too slow for normal tank filling purposes. A spotlight and a spare can of gasoline for the pump are not shown here.

There is no evidence at this time that any of these units are over loaded. We have taken the units almost any place a pack horse can travel. They have a record of fast getaway, early control of small fires, and timesaving mop-up. As an example of how practical they are, we converted them to "Ortho" sprayers during our spring campaign against the Black Hills beetle.

MOBILE RADIOTELEPHONE SERVICE ON THE FLAT TOP EXPERIMENTAL FOREST

HERBERT A. YOCOM

Forester, Southern Forest Experiment Station, U. S. Forest Service

A radiotelephone set mounted on the fire patrol truck has proved a cheap and practical method of reporting fires on the Southern Forest Experiment Station's Flat Top Experimental Forest near Birmingham, Ala.

The set as installed in the truck includes a receiver-transmitter unit, a control unit, and a very short antenna mounted on the truck cab. Power is supplied by the truck battery. The receiver-transmitter unit is in a weatherproof box approximately 28 by 24 by 17 inches in outside dimensions. The control unit is installed on the dashboard. It includes a green light that shows when the unit is switched on, a red light and a bell to indicate when the unit is signalled, and a telephone with a "push-to-talk" button that switches the instrument from listening to talking. The receiver-transmitter unit takes up space in the truck that ordinarily is usable. The control unit and antenna use space that is ordinarily wasted.

A conversation can be carried on directly between the mobile unit and any telephone connected with the Bell Telephone system. Calls from or to the radiotelephone are handled through a regular control terminal of the Bell system in Birmingham, about 15 miles from the Experimental Forest. A special operator at the terminal makes the connection. When the mobile unit is called, the bell rings once and the red "call" lamp lights and remains on until someone answers. The horn can be wired so that it will blow when the unit is signaled. When a call is made from the mobile unit, the caller uses the "push-to-talk" button to signal the operator, who takes the number and places the call.

Radiotelephone has been used on the Experimental Forest through the fall fire season of 1947 and the spring season of 1948. When fire danger is high, the unit is turned on all the time that the patrol truck is manned. During periods of low fire danger, it is usually turned on while the patrol truck is traveling and during the noon hour.

The telephone-company representative who demonstrated the unit pointed out that "dead spots" are sometimes encountered, usually in areas lower than the surrounding topography. His instructions were to drive on a short distance and try again. Although the unit on the Flat Top Experimental Forest has been used in the bottoms of hollows 400 feet lower than the surrounding topography, it has always been possible to make calls to and from the unit.

The telephone company furnishes the equipment and service for $22 per month for local exchange calls. This charge allows for 20 outgoing calls of 3 minutes each. Additional calls cost 30 cents each. There is no charge for incoming calls, but the caller has to pay any long distance costs. There was an installation charge of $25. The maintenance service, which is furnished by the telephone company at no cost, has been excellent.

The radiotelephone has definite advantages over an ordinary radio communication system. Radio has a higher initial cost and requires special arrangements for maintenance service. Moreover, the radiotelephone is directly tied to the existing telephone system. This does away with the need for stand-by sets and makes it possible for the operator of the mobile set to contact other telephones if the first does not answer.

Radiotelephone as a public service is relatively new. It has been available in Birmingham about 2½ years. At present, it is designed principally for urban areas, and is now in use in some 54 cities throughout the United States. The telephone company plans to expand the service as rapidly as possible. Probably the next step will be to make it available on all main highways. The distance that the service operates satisfactorily outside the urban areas varies considerably with the topography.

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CHALLIS FIRE LINE AND TRAIL PLOW

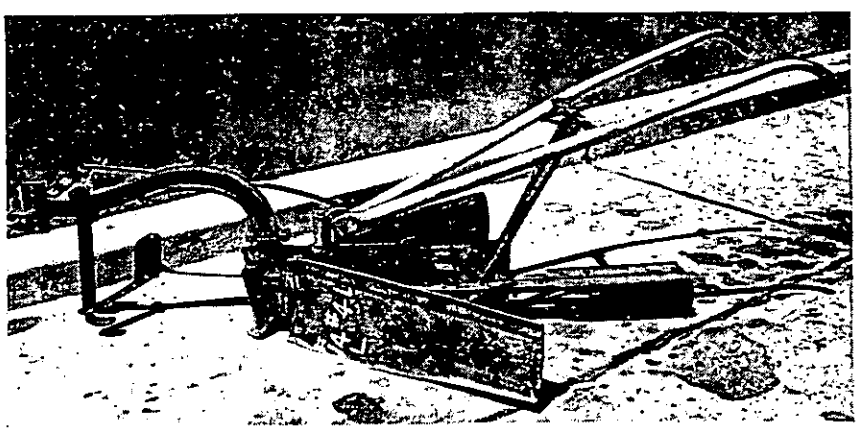
JOHN W. PARKER

Forester, Region 4, U. S. Forest Service

In our development of fire line equipment we have to keep in mind that a large part of the West does not lend itself to the use of conventional type of mechanized equipment such as tractors and tankers. The country is too steep and rough. The shovel and Pulaski are still the tools that build much of the fire line in too many cases. The hope of every fireman is that some successful gadget will be made that will do most of the job mechanically. Until that machine arrives we must make good use of the work horse and plow.

Merle G. Markle, fire control staff man on the Challis Forest, developed a V-type plow for fire lines that has possibilities. The plow will do the work if it is gotten out on the fire line with a good work horse and a trained crew. The Challis plow has developed into a good trail plow as well. Those who have used it on trail maintenance claim that it is superior to any of the other trail graders commonly used.

The Challis plow has a number of characteristics that are advantageous. A land slide prevents the plow from swinging from side to side. The handles are adjustable for individual preference and for securing better control while working on steep slopes. Wings of the V may bet set at any angle and either one or both may be used. Either wing can be raised out of the way for steep sidehill work, allowing the lower or cutting wing to function at its best. The point of the V is removable and different points are used according to the work being done.



The Challis plow showing details of construction.

The depth which the plow digs can be adjusted by different settings of the coulter and the heighth of beam. By an adjustable clevis and pull bar the draft horse can be so applied that the plow travels in a straight line and does not tend to run to one side.

Some of the advantages of this plow over the reversible hillside plow commonly used are that it makes a wider line and digs only deep enough to remove the fuels down to mineral soil. The point of the V is so shaped that it will not get hung up on roots and rocks. This was particularly bad with the conventional plow, causing terrific strain on the plow shaker as well as the horse.

The plow weighs about 130 pounds. This weight cannot be reduced very much and still get the performance through rough going. The plow needs the weight and it needs to be rugged. It can be disassembled for packing on a horse in a few minutes.

The cost of the plow if made by hand will be approximately $200. If it is made in quantity, this price could be materially reduced.

LITTLE TRACTORS IN FIRE FIGHTING

JOHN W. PARKER

Forester, Region 4, U. S. Forest Service

We have large areas in Region 4, as have other regions, where tractors can construct fire lines with greater speed and less cost than can men with hand tools. We know that large tractors of the D–7 or D–8 class once they are on the job can do more work and cover steeper terrain than any small tractor yet designed, but these big machines are slow to get there. Large transports with 20-ton loads move slowly over any mountain road. Short turns and weak bridges further delay them. However, for the big fires where several miles of line may be necessary the big machines are good business even though it takes them longer to arrive.

The problem is to get the small initial attack crew there soon enough with adequate equipment to control the fire before the big outfits are needed. The little H. G. Oliver tractor, Model HGP–42, built by the Oliver Corp. of Cleveland, Ohio, is a tool that promises to do much in strengthening these fast hitting crews. Some of its specifications follow:

Weight	3,600 pounds.
Width of tread	50 inches.
Length of tracks	6½ feet.
Width of dozer blade	6 feet.
Width of track shoes	9 inches.

In actual tests the tractor operated satisfactorily around a side slope of 40 percent without building a road to travel on. It appears stable and has little tendency to tip over. It would slide before tipping in most situations. The tractor tends to stand on its nose when backing up a steep slope, a characteristic of most little tractors. However, it moved up the 40-percent slope in reverse. Rocks and small poles hinder its climbing in reverse considerably.

The H. G. tractor can work down 60-percent slopes where rocks are not too much of an obstacle. Steeper slopes can be descended by a skillful operator if the ground is reasonably smooth. The tractor will climb slopes of 50 percent or more depending on the ground condition. The testing of the forward climbing ability of the tractor was limited because it has no fuel pump, a situation that can and must be remedied.

The tractor was operated through heavy brush including cherry, ceanothus, and willow, over terrain averaging about 10-percent slope. An adequate fire line was built at the rate of one-fourth of a mile per hour. It was the unanimous opinion that 25 men could not have done as well in the same length of time. The tractor also bucked a fire line up through similar brush on a 25-percent slope with comparative ease. By busting out a rough line up the slope and completing it on the return trip the line on the 25-percent slope was done at about the same

The H. G. tractor: *Left*, worked through this brush patch up a 10-percent slope with ease; *right*, built this 6-foot road through heavy brush on a 50-percent slope.

rate as that on the 10-percent slope. In open penderosa pine type on moderate slopes the H. G. tractor can build fire lines rapidly. As shown in the picture, a short piece of 6-foot wide trail was built across a 50-percent slope with ease. Where there is need the tractor can build itself a road.

The Beetle trail tractor lacks the power to do the fire job in any except the most ideal situations. The mobility of the Beetle is not appreciably greater than the H. G. tractor. A 1½-ton truck can transport the H. G. tractor easily.

There are a few bugs in the H. G. that should be corrected. It needs a fuel pump as mentioned before. There is no brake except that used in connection with the steering clutches. This is dangerous in steep country and could be remedied by having a foot brake operated by the right foot. The tractor has more power than traction and it is believed that if the tracks were 2 inches wider traction could be increased.

The premise is that if we can get a small force to any fire quickly enough after the fire starts they can control it promptly. This is a true statement for 99 percent of our fires and the force usually needs to be only a man with a shovel or water bucket. Since we cannot reach every fire in time for one man to extinguish it with these simple tools, we must provide better tools and in some cases more men. We have been quick to supply the increased number of men but slow to acquire better tools.

A 5- to 10-man crew used for initial attack equipped with back pumps, shovels, Pulaskies, a 100-gallon pumper unit mounted on a 4-wheel-drive vehicle and a H. G. tractor transported on a 1½-ton truck could be a potent force. The training of this crew, if it is to function properly, would prepare them to use the most suitable tool or tools to fight the fire at hand. There should be no hesitancy on their part to all grab shovels and go to work when the need arises. Briefly, they would not be essentially a tractor crew, but the tractor would be one of their tools to be used where it would best do the job.

Channel Iron Bed for Plow Carrier Truck.—The beds of our conventional Hi-Low semi-trailer, used in transporting tractor-plow units are usually constructed of 2- by 8-inch rough oak plank. The plank is bolted to the trailer channel sills to form the ramp and runway for the tractor-plow unit.

On a fire forest it becomes necessary to load and unload the unit many times during a season. The grousers on the tracks of the tractors soon wear out the wood flooring. In order to keep the bed of the trailer safe for transporting the tractor unit, it was necessary to constantly replace the 2- by 8-inch planks. This frequent replacement of the planking soon became quite an item of expense because of the high cost of good grade oak lumber.

Before the spring fire season started, the Ocala unit of the Florida National Forests, installed a channel iron bed on one of their carrier trucks. The channel iron used was 8 by 2 inches, bolted to the trailer channel sills with ½-inch bolts, with the cleat side up to form the floor of the trailer. Two bolts were used on each end of each channel floor piece.

To floor the 21- by 7-foot trailer bed, required 5 pieces of iron 7 feet long and 18 pieces 2½ feet long. The channel iron on the incline or ramp part of the trailer bed was spaced 8 inches apart. On the flat portion of the trailer, the 2½-foot sections of channel were used, spaced 8 inches apart but with a 2- by 8-inch plank left between each piece of iron. By placing the channel iron on the truck bed with the cleats up, good traction was obtained for the tractor tracks for loading and unloading. By having 2- by 8-inch wood pieces between each channel on the flat section of the trailer bed, the tendency of the tractor to slide from side to side while the truck is in motion was eliminated.

This change over from an all-wood to a steel-wood combination trailer bed has eliminated renewing the all-wood bed at frequent intervals and we believe will result in a more practical and safe trailer to use in transporting fire suppression tractor-plow units.

The channel iron used in making the bed cost $87 and labor to install the pieces on the trailer amounted to $10. During the past 5 months no replacement of the remaining wooden boards has been necessary. The steel channels take up the shock of the grousers and the wood serves as a cushion and stabilizer.—JACK THURMOND, *District Ranger, Ocala National Forest.*

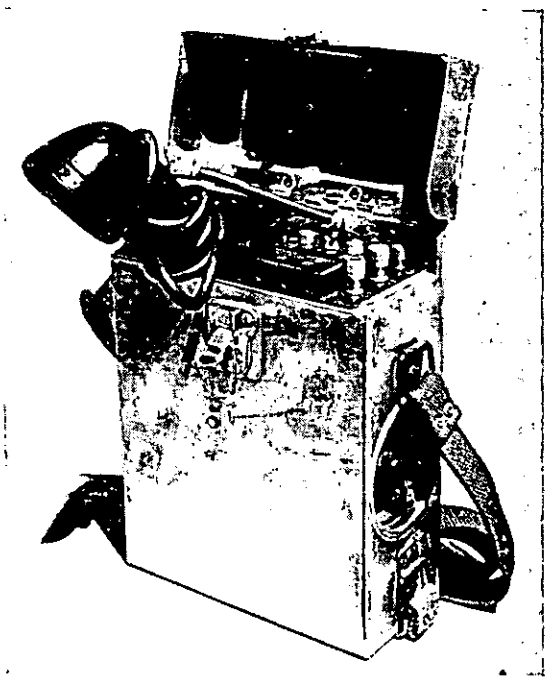
PORTABLE FIELD TELEPHONE

FRANCIS W. WOODS

Communications Engineer, Region 4, U. S. Forest Service

Region 4 has attempted to help the field man in his communication problems by assembling a metal-covered field telephone that will stand all the transportation abuses common to items hauled in pickups and carried on pack mules.

The development was not a complicated process but does give us a telephone we think the men can use. The telephone instrument itself is the Army EE–8–B field telephone complete with receiver, transmitter, ringer, and call bell. The performance of this instrument is equal to any of the better Forest Service telephones. The old



leather case that came on the Army EE–8–B phone did not protect it sufficiently for the hard use our field men gave it. To overcome this a durable case 5½ by 3½ by 9½ inches was made to house this telephone. Instrument and case together weigh 11¾ pounds. Field tests indicate that the unit is quite satisfactory both from the operation standpoint and from its ability to withstand hard use. The cost of this complete unit is about $50 if a new telephone unit is purchased. The Army EE–8–B field phone can be purchased as surplus for various prices. The cost of the durable case is about $10 when built by hand.

HOSE WASHER

H. M. White

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

Every year it is necessary to wash a considerable footage of fire hose, mostly cotton-jacketed rubber-lined, at the regional warehouse in Portland, Oreg. In bad years, the amount may be 50,000 or 60,000 feet. For many years, methods of washing without scrubbing have been employed, to avoid wear on the jacket.

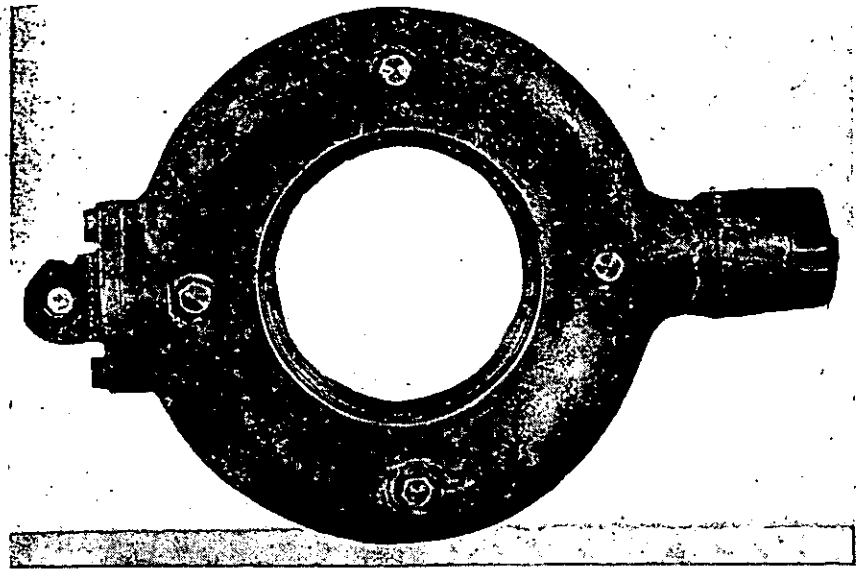
In the first really effective washer constructed, two short pieces of 1½-inch brass pipe, each having a narrow slot about 3 inches long, were installed several inches apart, so that as the hose was drawn between them, ribbon streams under fairly high pressure were directed at the hose from above and below. A good job of washing was done by this method, except at the edges of the flattened hose.

The installation of two additional sections of slotted pipe at right angles to the first two was being considered when Roy Walker, veteran warehouseman in charge of the fire cache, had a better idea. He designed what he called a "doughnut" casting, having a slot all around the hole.

The casting is made of valve bronze and an ordinary 1½-inch swivel hose coupling is brazed to the intake. The outside diameter is 9½ inches and the inside diameter 4¾ inches. The slot is cut at an angle of 30° to the plane center line, to increase the effectiveness of the stream. Width of the slot can be varied, up to 0.020 inch, by adjusting the four bolts shown. These bolts serve a dual purpose: Slot adjustment and strengthening the casting. We set the slot at 0.006 inch and use 200 pounds pressure.

The box in which the casting is installed can be constructed in various ways, of course. We use a box, 34 by 15 by 12 inches, made of ¾-inch waterproof plywood. The bottom consists of two pieces, sloped toward an opening at the center to let the water out. The ends have holes through which the hose is drawn and the casting is installed across the center, with the slot facing the entrance.

To support the hose as it is drawn through the box and casting, we use two assemblies of 16¼-inch rods about 15 inches long, set in a circle somewhat smaller than the inner diameter of the casting. These rods do not extend through the casting, as they would interfere with the stream. Their ends are set in brackets, attached to the four bolts. The forward assembly is about ¾-inch above the slot at the bottom so that the hose will not rest on the casting. The rear assembly is lower, so that the hose couplings will not catch on it.



"Doughnut" hose washer in same position as installed in box.

Preparatory to washing, coils of hose are soaked in a large tank for several hours to soften caked dirt. Then the hose is drawn through the washer and out onto the test and drying rack as fast as a man can walk. It comes out thoroughly cleaned of everything that plain water will remove. Water is supplied from an electrically driven gear pump.

Since the patterns for the casting are owned by the Forest Service, anyone desiring to purchase one may order from the Supply Officer, 2760 Northwest Yeon Avenue, Portland, Oreg. The one we have costs $5.75, exclusive of patterns and machining. The price would probably be somewhat higher now. The machining costs much more than the rough casting, of course. It could be done locally from a drawing to be supplied, or the Portland supply officer could have it done, if the purchaser desired.

PROPANE-DIESEL OIL FLAME THROWER

A. B. Everts

Fire Staffman, Snoqualmie National Forest

The October 1946 issue of Fire Control Notes described a flame thrower developed by the Los Angeles County Department of Forester and Fire Warden in which butane was combined with Diesel oil to produce an exceedingly hot flame for heavy backfiring jobs. In the Los Angeles unit, a compressor was used to pressurize the Diesel oil and, of course, an engine was necessary to run the compressor.

A somewhat comparable unit has been developed on the Snoqualmie National Forest which utilizes the gas pressure in such manner that an engine and a compressor are unnecessary. This is done by using propane instead of butane. The reason propane will perform the pressurizing function while butane will not is the difference in pressures at given temperatures as shown in the following tabulation:

Tank temperature (degrees)	Pounds pressure	
	Propane	Butane
40	63	3
60	92	12
80	128	23
100	172	38

B. t. u.'s per pound of liquid are: Propane 21,633; butane 21,331. Propane will start to vaporize at −44° F., while butane needs a temperature of 32°.

The Snoqualmie unit, also trailer mounted, is made up of two standard ICC, 600-pound test, 48-gallon propane tanks, to which have been added the necessary fittings, a hose basket, three 25-foot lengths of one-half inch Buna S-lined neoprene hose, and torch (fig. 1). The hose basket is welded to the tanks and provided with lifts, so that the whole unit can be removed from the trailer with a chain block.

The gas tank, not visible in figure 1, has a 10-percent valve, a top outlet valve, and a pressure relief valve, which is set at 300 pounds. The oil tank (shown) is identical except that it has a 1½-inch top filler vent for Diesel oil, a copper tube which runs to the bottom of the tank to release condensed moisture, a Davies type pressure release valve, and a pressure gage. Oil is released through the valve in the center of the head. A down curving tube runs through the center of the oil tank to within 1 inch of the bottom.

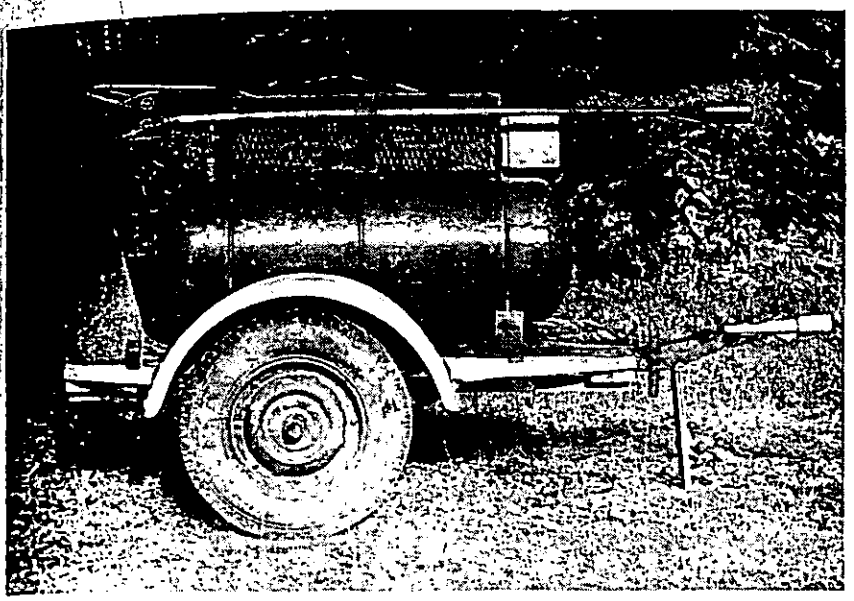


FIGURE 1.—Trailer type propane-Diesel oil flame thrower. The wooden end piece at rear is for protection of valves.

A copper tube runs from the gas tank to the oil tank to permit the propane to pressurize the oil, usually from 75 to 125 pounds. When the oil tank is empty, pressure is relieved through the Davies type valve and the tank is refilled. This valve is a standard safety installation for this type of equipment. If the escaping gas should be ignited, the screen on the valve would prevent the flame from getting into the tank.

To fill the gas tank, a standard propane tank is up ended and elevated so that the liquid gas will flow through a special hose. The 10-percent valve is opened slightly to allow the air or gas to escape. When the incoming liquid gas reaches the 10-percent valve, a mist is released, indicating that the tank is filled to the safe working level.

The torch is 6 feet long. It is made of 1-inch stainless steel tubing, with a naval bronze mixing cap at one end and two valves at the other, one for gas and one for oil. In hard-to-ignite fuels, such as old logging landings, the gas discharge may be reduced and an excess of gassified oil applied to the fuel, after which the gas is turned on full again to produce a flame as shown in figure 2.

The reason for breaking up the hose supply in 25-foot lengths is the high friction loss in small hose. The pressure obtainable from the propane tank is sufficient for a reasonably long flame throw with 75 feet of hose, but where that much is not needed, it is desirable to use a shorter length and thus increase the flame throw.

Freezing, which frequently occurs in any liquid as it converts to gas, has not been a problem with this unit. The reason is that the

FIGURE 2.—Propane-Diesel oil torch with oil and gas turned on full.

freezing is in direct relation to the surface area of the liquid, and with the tank lying on its side the surface area is sufficient to prevent freezing.

Two of the trailer units were purchased for ranger use. They were so well received that a third ranger, with a large amount of slash to burn, also wanted one. By this time an improvement had been added. Why should the propane tank be filled when tanks provided by the oil companies can be used just as well? In this case, when a gas tank was empty, it could be replaced with a full one. There was only one problem: with a full tank lying on its side, liquid would be drawn off instead of gas. This was solved by installing a vaporizing cylinder, 6 feet long and 6 inches in diameter. The gas enters the vaporizing cylinder on the bottom as a liquid. It is withdrawn at the top as a gas to pressurize the oil tank and to furnish gas to the torch.

At this writing the three units described have been used to fire sagebrush in a range reseeding project, burn out a slab and sawdust pile at a small mill, fire log landings, set slash fires, and burn piled brush. It has been suggested that it might be a formidable weapon to fight the invasion of Mormon crickets which occur periodically in some of the Western States.

From experience gained so far we believe one filling of propane on the trailer unit will last through 4 or 5 days of judicious burning. About one tank of oil is required daily.

Pressurizing oil with propane gas is the idea of a Seattle manufacturer, who has applied for patent on the idea as well as on the dual control torch which is used with the unit.

Since a heavy unit, as described, is limited to roads and tractor trails, there is need for a companion unit for use on rougher and steeper terrain. Such a unit is shown in figure 3. In theory, it operates in the same manner as the propane torch shown in the Fire Control Equipment Handbook. Its advantage over the old type is that, while it carries nearly twice as much propane, it weighs only 45 pounds as compared with the 47 pounds of the old type. The tanks are shatterproof stainless steel oxygen tanks tested to 600 pounds and provided with a safety release set at 175 pounds. The tanks are mounted on a plywood packboard which gives protection from freezing not provided in the clack board mounted older type. The torch is light and has a thumb controlled valve. A 10-percent valve is provided for safety in filling.

FIGURE 3.—Improved back-pack propane torch.

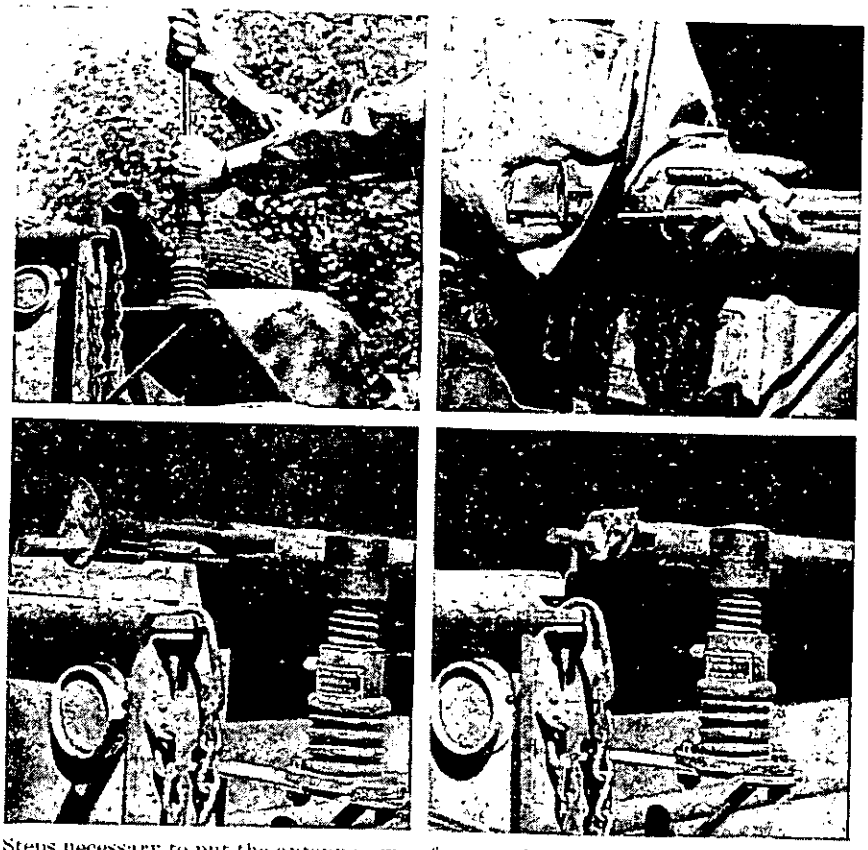
In a later version of this torch, one tank is used for Diesel oil which, as in the trailer unit, is pressurized with the gas. This unit has two hose lines. It can be used with both tanks filled with propane or with one tank of gas and one of oil.

CARRYING A TWO-SECTION WHIP ANTENNA FOR PORTABLE RADIO

DON M. DRUMMOND

Assistant State Fire Warden, Nevada

Elko County is one of the largest counties in Nevada. It is bigger than the combined area of the three smallest States in the Union. In this sparsely settled country, single fires have been known to burn thousands of acres of range forage. Ranches, including the hay



Steps necessary to put the antenna away for carrying: *A*, Dismount antenna from base mounting spring and loading coil; *B*, fasten carrying cap to two sections of antenna; *C*, slip antenna into "carrying case"—rolled edge of pickup bed; *D*, fasten cap with wing nut, stored antenna is in travel position.

stacked for winter, miles of fences, ranch buildings and homes, have at different times gone up in smoke. Communication is a vital problem in fire control work on such a large area with so few people.

Through Government surplus the Nevada State Board of Fire Control and the Nevada Extension Service secured several portable radios—Fisher type RS253 and TW253. Elko County is experimenting with them. The county fire warden has learned that the vertical two-section whip antenna is too heavy and tall to be left mounted during all his miles of travel. The radio sets are portable—not mobile—requiring that he stop his vehicle before using the radio. He must carry the antenna where it is well protected, and also in a position where it is easily and quickly available. He slips the two sections of the antenna into the rolled edge of the pickup bed and holds the ends of the antenna firm with a special cap he has fashioned. A wing nut holds the cap and antenna "in storage." The antenna can be unpacked and set up in a matter of moments.

BACK-PACK PUMP CARRIER

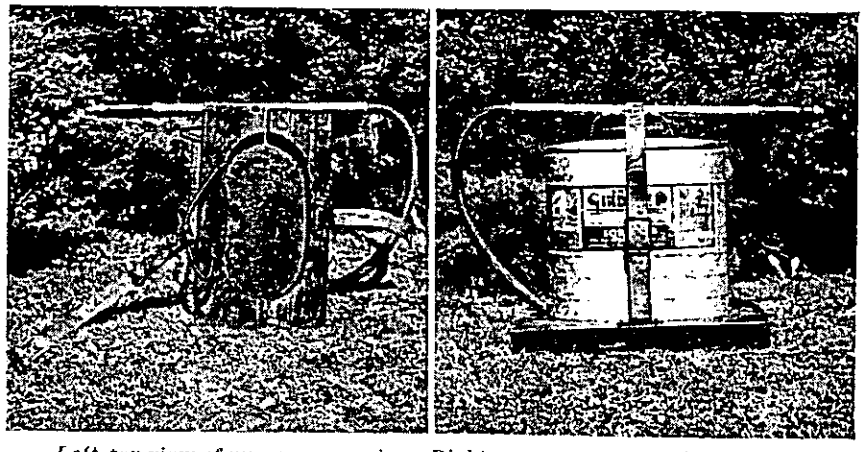
JOHN W. PARKER

Forester, Region 4, U. S. Forest Service

The back-pack pump can has become a standard piece of fire fighting equipment in several sections of the country. These cans are carried in trucks, pickups, tankers, and other vehicles. The problem is to have a carrier that will hold these in place so they will not get damaged or spill the water when being hauled. The safety of the men who ride in the vehicle is also involved. Quite frequently a pump can must be carried in an administrative pickup being used for other work and it is necessary that it be placed on the running board or other convenient place where it will not be in the way. There are several pump carriers on the market but they are expensive and usually will accommodate only one make of pump can.

The Wasatch Forest developed a back-pack pump carrier that can be constructed cheaply and can be made to fit any shape pump can. The Wasatch pump carrier requires the following materials with their estimated costs:

2 pieces 2- by 6-inch lumber	$0.25
1 piece leather strap 1½ by 36 inches with buckle and keeper	1.50
1 screen door spring, extra heavy type	.15
1 piece 5-ply plywood for bottom	.25
Total material cost	2.15
Labor to assemble	1.50
Total cost	3.65



Left, top view of pump can carrier. *Right*, pump can mounted in carrier.

The screen door spring is attached to the bottom in the form of a loop. The leather strap is fastened to the loop. With this arrangement the strap when buckled is under constant tension from the spring, thus holding the can firmly in the base.

Two bolts will hold this carrier securely to a truck bed or a running board. Two brackets will hold it on the side of a vehicle if there is no space available on running board or truck bed. A detailed plan for the back-pack pump carrier may be obtained from the U. S. Forest Service, Ogden, Utah.

Ruidoso.—Ruidoso, N. Mex., has been something of a fire problem to the Lincoln National Forest, which surrounds it, for a number of years. The town is situated along the Ruidoso River on a stringer of patented land 4 miles long and ranging in width from ¼ mile to 1½ miles in the heart of the ponderosa pine type. This 4-mile strip of private land is traversed by the main road or main street, with only one outlet to the north over a secondary road at about the midpoint.

Prior to 1920 Ruidoso was just another small, mountain country community. The local people were dependent on farming and ranching. One or two small sawmills operated on a part-time basis and contributed very little to the local economy.

By 1925 Ruidoso had grown. There were a number of summer cabins constructed along the river and people were spending the summer months there. It was considered advisable for the District Ranger to maintain a summer camp in Ruidoso to take care of the fire problem. At this time, "everyone" except the postmaster left Ruidoso in September, came back in November to hunt, then stayed out until the following May or June.

Ruidoso continued to grow; and so did the fire problem. To get some idea of the magnitude of this problem, one must consider that Ruidoso grew within a short time from a summer home group into a thriving summer resort with crowds estimated at 12 to 15 thousand for week ends and 18 to 20 thousand for the Fourth of July celebrations. The fire problem remained the responsibility of the Forest Service. Key individuals in Ruidoso gave excellent but limited cooperation.

In the early development of the Ruidoso area the Forest Service realized the responsibility of local fire protection belonged to the town of Ruidoso. However, the situation was such that it was necessary to protect Ruidoso in order to protect the forest. At times the outlook was very discouraging. Lack of fire-fighting equipment was a handicap to both the Forest Service and the town. Rakes, shovels, and back-pumps were standard equipment up to 1939. In 1939 an Edwards pumper and 1,000 feet of hose was purchased for the Ruidoso area; in 1945 a tanker truck was added. In 1948 a new up-to-date fire engine was purchased by the town.

At the spring fire meeting this year the Ruidoso fire department took over the responsibility for suppressing all fires in the Ruidoso area, the Forest Service to assist when called upon. The Forest Service was to handle all fires outside the area, the Ruidoso fire department to assist when needed.

To me two points in handling this problem are outstanding; the number of man-caused fires and property loss have been held to a minimum, and the working relations between the town of Ruidoso and the Forest Service have been very good at all times.—LEE BEALL, *Range Conservationist, Lincoln National Forest.*

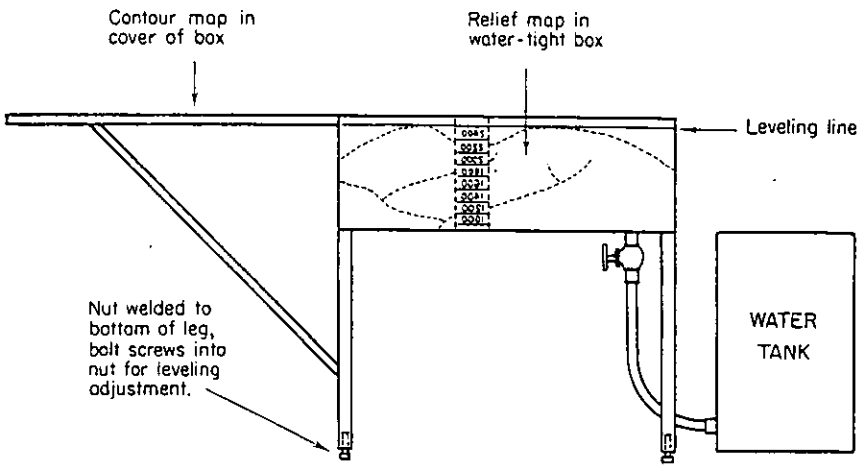
DEVICE FOR TEACHING CONTOUR MAP READING

RALPH G. BROWN

District Ranger, Stanislaus National Forest

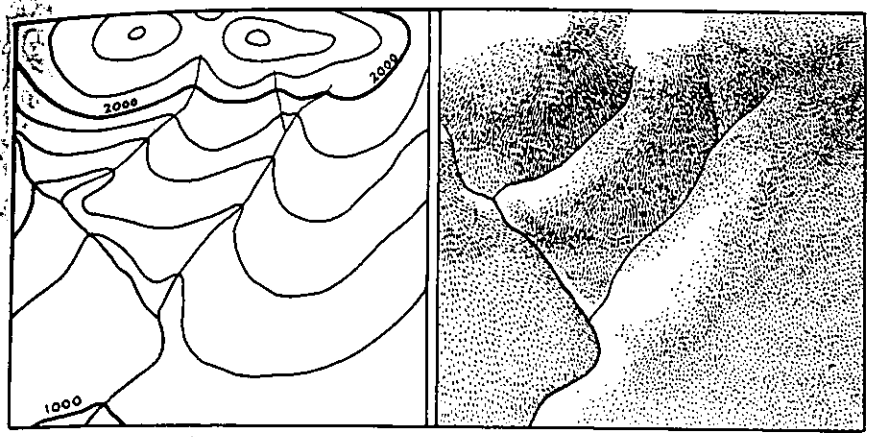
Device consists of:

1. Water tight box with legs adjustable for leveling.
2. Relief map built up inside of box showing peaks, saddles, ridges, creeks, various slopes, benches, etc.
3. Line marked inside of box, near top, to use as leveling guide with water.
4. Vertical scale mounted inside of box, graduations coinciding with contour interval.
5. Drain installed through bottom of box.
6. Water container capacity equivalent to map box, connected by rubber hose and shut-off valve to drain.
7. Contour map mounted in lid of box, depicting the topography of the relief map and on the same scale. Contours numbered to correspond with those on the vertical scale in map box.



How used:

1. Map box set up and leveled.
2. Shut-off valve opened and water tank raised above level of box allowing relief map to be flooded. If dye or other coloring matter is added to the water to make it opaque it is more effective.



3. Valve shut off and tank returned to position below box.

4. Valve cracked to bring water level down to number on scale representing highest contour on contour map. *Water line on relief map corresponds and represents contour line on contour map in lid of box.*

5. Crack valve and lower water to next graduation on vertical scale. Repeat process for each contour with explanation.

SPIRAL ROTOR TRENCHER

T. P. Flynn

Equipment Engineer, Region 6, U. S. Forest Service

The spiral rotor trencher is a light-weight, motor-driven machine being developed for fire-line construction. A revised pilot model was completed and given preliminary field tests 3 times in June and July 1948. The most recent test was conducted at high elevation in the Cascade Range on the Mount Hood National Forest.

The most noteworthy mechanical feature of the machine is the 2-way tapered, spiral rotor digger or trencher tool, a positive excavator type rotating between 250 and 300 revolutions per minute.

Trencher showing arraugement of the spiral rotors.

Power is supplied by a 6-horsepower, 4-cycle Salisbury motor. The spiral excavator uses about 70 percent of the power and the traction wheels about 30 percent. Power steering to the tractor wheels is incorporated and appears well worth while in that it greatly reduces fatigue of the operator. Positive chain drive propels the spiral rotor and delivers the primary power to the rear wheels.

An important improvement in the latest revision of this machine is an automatic slip clutch installed in the power drive line to the spiral rotor. This slip clutch goes into action when excessive overloads are caused by collision of the rotor with immovable objects. It dissipates a large amount of shock that otherwise would reach the motor and main transmission. This feature is well worth the additional cost involved because it serves as insurance against breakage of valuable parts in the transmission.

Traction wheels are 24 inches in diameter and 24 inches apart (center to center). The axle is 12 inches from the ground with the transmission partly underslung. The complete unit, which weighs 500 pounds in its present form, has a low center of gravity and good stability for rough country operations. Its travel speed is 1 to 1.3 miles per hour.

Ground conditions for the tests made on the Mount Hood generally would be considered difficult for almost any size of machine, because of very frequent and heavy lava rock outcrops. Specifically, the average ground condition in which the trencher was used classified as about 75 percent red clay soil and 25 percent small boulders from 4 to 8 inches in diameter. Cover consisted of a heavy stand of pine timber with a heavy undergrowth of small manzanita brush; quite a few down logs and broken limbs were present on the surface. There was usually sufficient space to maneuver the trencher around the large logs and between the heavy patches of manzanita brush as well as between the rock outcroppings.

To determine the limitations of the spiral rotor trencher, its durability, output, and quality of trench under rough conditions, and its ability and effectiveness in general, trenches were made up steep grades, on sidehill, downhill, and on the outer fringes of heavy rock outcrops.

Stop-watch checks showed that in reasonable ground conditions, at least 20 percent rocks and boulders in this case, excavating speed was approximately 1.1 miles per hour. This speed allows the operator just about the right amount of time to pick his course. Trench width averaged about 22 inches of actual excavation and the berm of cast out materials on each side averaged about 7 inches. Although the depth of trench could be controlled easily by the operator's handle, an average depth of 4 to 5 inches was used as a standard, principally because this depth permitted the outer ends of the spirals to clean up the outer edges of the trench and leave a neat line without any fallback.

The tendency of the rotor is to dig or excavate at all times without any excess force applied from the operator's handle. It does not lead into the ground fast or suddenly, and when it encounters immovable objects, such as large boulders or roots, the rotor automatically climbs and slides over them.

The spiral tool excavates and pushes dirt both ways from the center. Its taper in diameter from the center outward accomplishes two things: Reduces excavating load pressure on the outer ends of the tool, and

Trencher in action. Note splash and the clean trench constructed.

tapers the bed of the trench upward toward both edges. The excavated materials deposited at the edges of the trench remain very firm so that fall-back is practically negligible.

The spiral splashes dirt about 2 feet from its outer ends. Although it was not intended that this pattern of spiral was to throw dirt very far, the small splash would be beneficial when working close to a fire line.

One interesting discovery about the behavior of a spiral rotor working at right angles to the line of travel, made during earlier experiments, was that better results are obtained when the spiral rotates in the opposite direction from the tractor wheels than when it rotates in the same direction. Rotating the spiral in the same direction as the wheels, instead of providing some forward traction as well as excavating, resulted in a tendency to climb out on top of the ground and otherwise leave ragged edges to the trench. Rotation was reversed and the spiral now does its excavating on the upturn, coming from underneath against the cut. The spiral rotation now used leaves a neatly excavated and highly satisfactory fire trench.

At this stage there appear to be only a few adjustments, such as reducing the travel speed some to favor the operator when excavating in difficult ground, and simplifying and streamlining the power transmission to the tractor wheels. The spiral trencher tool is the outstanding feature of the machine and its shape and relatively low rotating speed reduce the possibility of damage or breakage to a minimum. The 6-horsepower motor used is adequate. The proportion and balance of the machine appear to be quite satisfactory.

DRIVEN WELLS FOR FIRE SUPPRESSION

EDWARD RITTER

Region 7, U. S. Forest Service

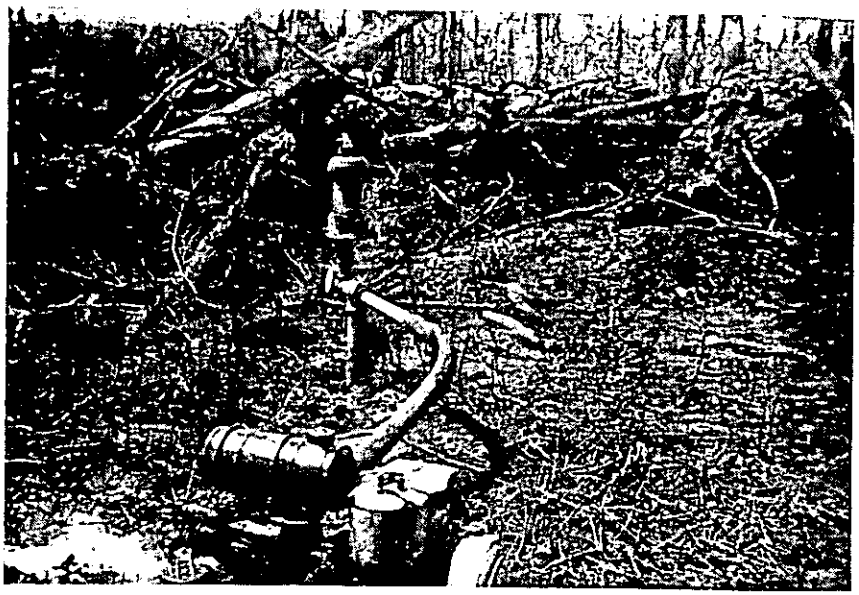
An old story need not be often repeated unless it serves a particular purpose. There is little new in this story as it describes the use of water on forest fires. But because it deals with a specified locality and individual fires, it is thought the information may be of interest to others. The area is Cape Cod, Mass.

Growing up as a westerner and working on forest fires in the dry ponderosa pine type of the Inland Empire has tended to make me water conscious if only from a standpoint of having sufficient drinking water on the fire line. In 1930 while reading accounts in the Idaho Statesman of the serious forest fires in the East little did I think that some day I would be back there and find out first-hand what some of their problems were. Cape Cod, instead of being the mass of sand dunes I had expected, turned out to be a relatively rugged area of forest land, much of which is strewn with massive boulders and rock formations. The use of driven wells did not look very practical at first but the district fire warden, Massachusetts Department of Conservation, had progressive ideas and wanted to prove to his satisfaction that driven wells could be used to advantage on forest fires.

Use of water from driven wells for forest fire suppression is not unique although it is believed that the following instances, described by E. Ormand Dottridge, district fire warden for the Cape Cod area with headquarters at Cotuit, Mass., may serve as reminders of what might be accomplished elsewhere under certain conditions.

The Horse Pond fire which occurred at 3:40 p. m. on August 24, 1947, on a class 3 day was controlled before mignight of August 24, mopped up and declared out at 4 p. m. August 25. Although the fire was only about 5 acres in extent, 1,100 feet of line was bulldozed between two ponds to aid in corral, and the remainder of control and mop-up was completed entirely with the use of water. Fourteen thousand and three hundred gallons of water were applied through use of 5 fire trucks and 83,140 measured gallons were applied by 2 portable power pumps using the ponds as a source of water although driven wells would have served satisfactorily. Only 2 hose lines were used, each about 500 feet in length.

On August 6, 1947, at 11:15 a. m., a fire started near South Mashpee. It was a class 3 day, but only 1½ acres burned. The fire was knocked down by use of a county brush breaker and a town fire truck. A portable power pump was attached to a hand-driven 2-inch well pipe with a common button point and a 60-mesh screen. The well was placed in about the center of the burn and 200 feet of 1⅛-inch rubber-lined hose was sufficient to accomplish the complete mop-up job. A one-quarter-inch nozzle tip was used and an average of 12 gallons per minute was pumped. Between 4:30 and 9:30 p. m., August 6, 3,600 gallons were played on the burn and 4,320 gallons between 8:30 a. m.



Portable pumper at work on South Mashpee Fire, Cape Cod, Mass., August 1947.

and 3:30 p. m. of August 7. Seven tank trucks were used to apply 9,080 gallons of water on the burn during the 2 days, making a total of 17,000 gallons.

District Fire Warden Dottridge stated it took 20 minutes from the time the equipment arrived on the scene until water was being pumped on each of these two fires. He has loaded on a half-ton pickup truck a set of equipment which includes 2,400 feet of 1½-inch linen hose, 400 feet of 1⅛-inch rubber-lined cotton-jacket hose, two portable pumpers, suction hose, Siamese fittings, adapters and nozzles, two back-pack pump cans, two 5-gallon cans of gasoline, one 2-gallon gasoline can, a small complement of hand tools and the well equipment.

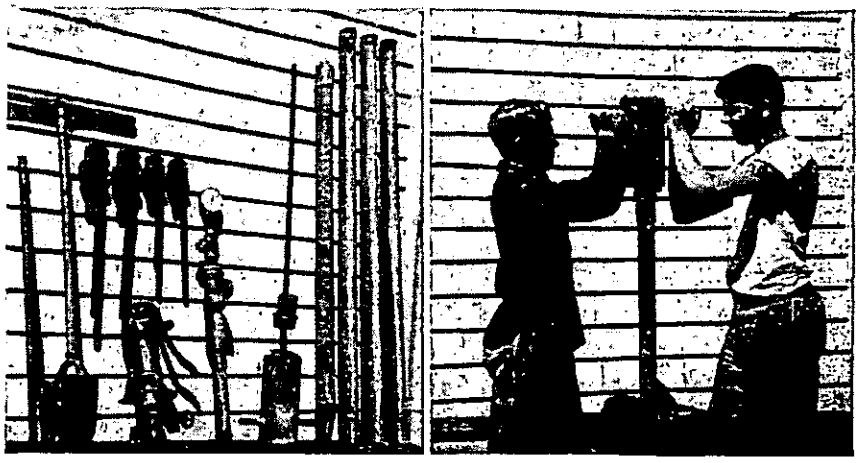
Driving a well point is not so mysterious as it is laborious. The accompanying photographs illustrate what tools and equipment are necessary and show how they are used. A list of the materials purchased by the Massachusetts Department of Conservation is as follows:

Quantity	*Item*	*Estimated cost*
1	2- by 48-inch washer well point	$12.00
3	5-foot lengths, 2-inch galvanized threaded pipe	12.90
1	2-inch galvanized tee	.82
1	2-inch galvanized plug	.20
1	2- by 1½-inch galvanized bushing	.28
1	2- by 1¼-inch galvanized bushing	.28
1	2-inch malleable iron drive cap	.50
4	2-inch wrought steel couplings	1.76
1	2-arm well driver, 60 pounds	5.00
1	3-inch pitcher pump	5.10
1	3½-inch vacuum gage	9.60
2	24-inch pipe wrenches	9.50
2	18-inch pipe wrenches	5.50
1	1¼-inch galvanized pipe, threaded on both ends (1½-foot length)	.85
1	1½-inch smooth bore suction hose, female couplings (4-foot section)	3.52
	Total	67.81

Driving the well is simple. First dig out a few scoops of sand or gravel with a round point shovel and post hole digger until the water table is reached. Then place the well point in a vertical position and begin applying muscular action to the 60-pound well driver which can best be operated by two men. When the well point has been driven into the ground sufficiently, make fittings of a 2-inch tee, vacuum gage, pitcher pump, and gate valve. Next, attach suction hose from pump and all is in readiness to start pumping water. When there is no further need for the well, the point may be pulled or it may be capped for future use if desired.

Points which are well to remember if one is interested in trying out driven wells on his district are listed here for consideration.

1. A fair knowledge of the local water table level and wells already driven in the immediate area should be helpful.
2. Study geological survey maps, water levels in adjacent ponds, streams, and swampy areas.
3. Confer with persons using driven wells in the adjacent area at similar levels.
4. Test wells by stand-by crews in areas likely to be used for underground water supply in case of fire.
5. Consult engineers who have made surveys of ground water supplies for municipalities.
6. Ten gallons per minute should be expected from a 2-inch by 4-foot, 60-mesh well point under poor to average conditions and much more under favorable conditions.
7. A series of two or more points may be driven at intervals of 10 or more feet.
8. Any type of pumping equipment may be used.
9. Avoid if possible heavy vacuum on shallow wells. There is danger of rupture of the button screen which would allow sand or gravel to enter the well and possibly ruin a gear pump.



Left, equipment necessary for well driving includes post hole digger, pipe wrenches, pitcher pump, well head assembly with vacuum gage, 60-pound well driver, button type drive point, and three sections of well pipe. *Right*, driving the point is laborious, but two men can complete this operation in a few minutes.

10. After well is driven, use pitcher pump to pump off discolored water into a container. If sand or gravel shows in bottom of container, use caution in operating gear pump. Discolored water may persist indicating for example, swamp water. This will not be harmful so long as there is no evidence of sand or gravel.

11. Take a sample of water from the pump occasionally to determine if button has been ruptured.

12. After pumping for an extended period an increase in vacuum may be noted. This may be due to the draw-down. Vacuum should remain fairly constant with a steady rate of demand by the pump. A constant increase in vacuum might indicate unfavorable soil conditions or rupture of a button screen, and that the well is filling up with sand or gravel. A sudden increase in vacuum would probably indicate rupture of the button screen. These points must be given consideration during all trials and careful observations should be made to avoid damage to equipment so that best results may be attained.

District Fire Warden Dottridge feels that the possibilities of using water from shallow wells may be greater on his district than he had first anticipated. He says, "why lay hundreds or thousands of feet of hose if there is usable water a few feet underground that can be tapped by use of wells?"

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

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