#6

SEPTEMBER 20, 1937

FIRE CONTROL NOTES

A PUBLICATION DEVOTED TO THE TECHNIQUE OF FOREST FIRE CONTROL

FOREST SERVICE - U. S. DEPARTMENT OF AGRICULTURE

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WHAT FUTURE HAS FIRE CONTROL NOTES?

Amazing results may be produced by cooperation. Accomplishments by the AAA and labor and business groups are determined primarily by the degree to which the principle of cooperation is applied. The world of science would be relatively barren without the highly developed cooperation which has grown up among scientists. Where the spirit of cooperation has been well developed, fire control has an effectiveness which does not otherwise exist. Cooperation or the lack of it will make or break FIRE CONTROL NOTES.

If workers in fire control take a pride in this publication as the organ of their occupational group, they will be critical of published articles having only a mediocre quality; if they feel an individual share in the collective responsibility for the character and quality of FIRE CONTROL NOTES they will be on the alert for chances to make, or get others to make, contributions which will be appreciated by readers concerned with the new science and art of fire control. When they find published articles of value to them individually, they will be impelled to respond by distilling from their own work the things which, if written up, would be of value to others.

The time has come when the publication will inevitably have tough going. The men most willing to contribute have done their share. The material most easily put in shape for publication has been printed. FIRE CONTROL NOTES will naturally feel the tendency to peter out. But it will take the upgrade promptly if workers in fire control really desire a publication devoted to that subject and cooperate to make it worthwhile. Will you individually do your share?

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FIRE CONTROL NOTES

SEPTEMBER 20, 1937

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

BLACKWATER FIRE ON THE SHOSHONE

DIVISION OF FIRE CONTROL

Washington, D. C.

Preliminary reports in hand as this issue goes to press show that initial action on this lightning fire was alert, prompt and vigorous—quite remarkably so, considering that the Shoshone is rated as a low-danger forest, and doesn't even have lookout stations. The country was high and steep—just below timber line. In spots the lodgepole and fir were dense and limby—the familiar patches of rather scrubby jungle found on the better sites at high elevations. There were steep slopes covered with dense but not jungly stands—just the setting for wind-driven crown fires of intense heat. Pictures of the area show bare ridge tops and open places here and there. Fuel on the ground seems to have been quite light—as would be normal under such conditions. One would guess that the fuel experts would rate the area at "Low rate of spread" and "Low resistance to control." But when the "heavy" wind started sweeping this way and that on Saturday, August 21, fifteen men lost their lives. Six of these died from their burns after the blow-up.

The danger from such accidents probably is statistically less than the danger from automobile accidents, which is so familiar we largely ignore it. But such fire accidents do happen and impress us all the more because of their infrequency. This is the largest loss of life from a single National Forest fire since 1910. It is the irony of fate that it had to occur on a National Forest which, so far as can be determined from the records here, has had only one other large fire during its whole history. The latest reports on size of this fire put it at 1,100 acres.

To the men who died in this disaster, all fire control men everywhere pay tribute. To the bereaved families they extend the deepest sympathy. To the survivors, and particularly the exceptionally large number of in-

jured men, is extended appreciation and cordial concern from all those engaged in the high adventure of protecting American forests from devastation by fire.

District Ranger Post's statement is published as an authentic case record of the processes of judgment in such situations where a man must think first and think clearly about the safety of the men in his crew. His words will recall to all experienced men many days of harassed effort to get the line ahead and the fire mopped up before something happened—but always with a running accompaniment of a plan (sometimes unconscious) for the best way to safety for the crew if something went wrong.

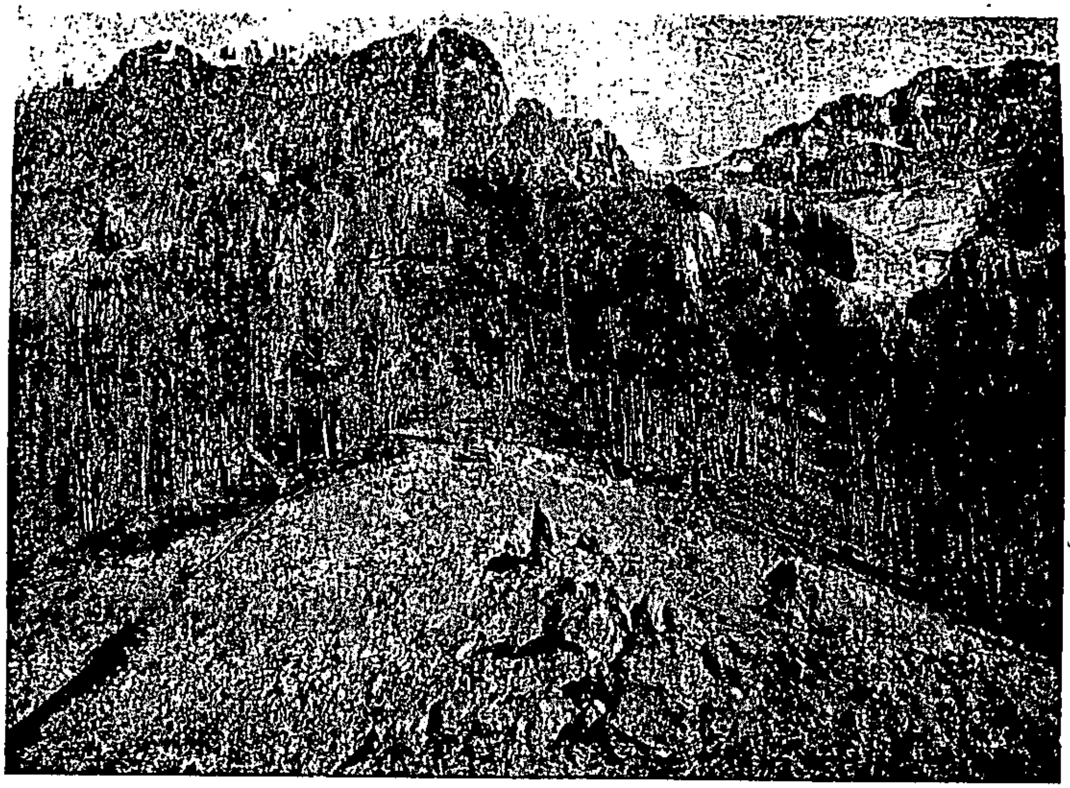
His statement is also a technical case history of the handling of men in such crises. His record could be followed better with the aid of a map, but even without it much can be gleaned from the story.

As a record of unassuming heroic conduct the statement needs no comment. It was dictated straightaway in the presence of D. P. Godwin, with no rehashing or editing except the correction of the spelling of one name and the insertion of the name of Bert Sullivan in one place. Post has some bad burns, and both hands and both sides of his face are heavily bandaged. He is out of danger, but will bear scars.

Junior Forester Tyrrell of Ranger Post's party died later from his burns. In speaking of him in his signed statement, Enrollee Alcario Serros says:

> "Then we saw that we didn't have no chance to go back, so Ranger Post told Mr. Tyrrell to take care of us, and he took us up to the rim rock. The fire started from the east, and then south, and then the west. It was the west fire that burned us. As the fire came closer to us we layed down on the rock ridge. Mr. Tyrrell layed on top of me. When the fire burned Mr. Tyrrell he ran and I ran, too, about 10 feet."

District Ranger Clayton, whose message Ranger Post received, died with six of his men. A seventh got out, but died from his burns.



When cut off from the safety sought to the east above timber line in the picture, Post and forty men who followed his instructions survived by taking what shelter they could, first on the left (north) side, then the right side of this bare spot in a ridge. Junior Forester Tyrrell died later from burns inflicted by the flames and heat which swept over them.

STATEMENT BY RANGER URBAN J. POST

I was in camp at the Road Maintenance Camp on Granite Creek, Shell District, Bighorn National Forest when I received a telephone message through a summer home permittee at 12:30 a.m. Saturday morning, August 21, to the effect that Mr. Conner had ordered me to report to the Supervisor on the Shoshone Forest for fire duty. I left camp in a pick-up with an outfit probably not later than 12:40 or 12:45 and arrived in Cody at the Supervisor's Office at 4:30 a.m. Mr. Anderson and Mr. Marion were in the office on fire duty and it was there I learned that I was to have charge of a group of men coming from the Bighorn.

We talked the situation over and decided that there was nothing to be gained by my going into the fire area ahead of this crew, so it was decided that I would take the necessary tools from the fire stock at the Cody Warehouse, drive on as far as trucks were permitted to go towards the fire and await the arrival of the men. This was done and I arrived at the end of the truck road on Blackwater Creek approximately 9 a.m.

There was some delay in the men getting there and I believe it was 11:20 or 11:25 a.m. when the crews from the Bighorn arrived at the end of the truck road on Blackwater Creek. During the interval between 9 a.m. and 11:30 a.m. all preparations were made to handle the crew after their arrival, tools were laid out where they were readily accessible, the Army was requested to prepare food so that the men could be fed before they started up the trail and our men from the Bighorn were fed as near as I remember at Noon, 12:00 a.m. As soon as any reasonable number of men had finished their meal, I left orders with the Foremen, Tyrrell and James Saban, accompanying the men as to the tools to be taken and other preparations to be made.

James Saban arrived with the last truck load and was instructed to bring up the rear of the party and see that all the stragglers arrived on the job. At approximately 12:20 the head of the party moved up Blackwater Creek from the end of the truck road toward the scene of the fire. We continued right on up past the Upper Camp. At approximately 1:30 the head of the column arrived at the burn of Friday the 20th on the main Blackwater Creek. There we met Supervisor Sieker who outlined the action of the day before as nearly as possible, the conditions existing on the fire at that time, the length of time and condition of men who were already on the fire line, and I was instructed to proceed to the east with my party. We followed the edge of the fire with instructions to pick up all Cody Camp men who were on patrol, turn them over to their Foreman and send them in for

rest. Likewise, I was to contact the Foreman of the Park Service men and instruct him to the patrol line already built. We were to go beyond the line constructed which included line constructed by the BPR Party, who were east of the Park Service crew and start construction beyond this point.

Mr. Sieker informed me that the Basin to the east was the only bad place left, that the other portions were fairly well caught up, that he was very tired from his work of the day and night before, and that he would turn over the job in the Basin to me and he felt that he would have no worry. He told me that there had not been much line constructed to his knowledge in the Basin and that after that part of the line was controlled, he was sure that the whole fire would be managed. In fact, our conversation led me to believe that there was no more than ordinary fire duty and so as far as he was aware, no extraordinary danger existed.

At that time he asked me how long our crew would be able to take the work. I replied that if he would see that lunches were brought to us some time during the night that I saw no reason why our crew could not function through the night provided we were relieved during the following morning. Mr. Sieker expressed his satisfaction of this arrangement.

About this time Ranger Clayton arrived on the scene and I met him for the first time. We had a very brief visit because we were quite anxious to get on the job. I was concerned at the present time particularly with seeing that the Foremen understood that all water bags, canteens, and back pack pumps should be filled before leaving Blackwater Creek because the information available at that time did not indicate that water was available in the area into which we were going. Men with back pack pumps were ordered to only half fill the cans because of the stiff climb ahead. The party left Blackwater Creek with myself and Paul Tyrrell in the lead. James Saban was to bring up the rear and we proceeded southeast up an open ridge along the fire of the day before. At about one mile distance we contacted the Park Service crew. Arrangements were made with Mr. Wolcott (Park Service CCC Superintendent) to patrol the line that he had built and send men back to the line being patrolled by men relieved out of the Cody Camp. One spot fire about 35 feet in diameter was passed and we stopped to caution the leader in charge of the men there to get up and do a little work on that spot fire rather than sit and watch it because there were a good many burning stumps in the area. This spot fire was directly opposite the almost dead burn of the day before.

After passing Mr. Wolcott's crew, we proceeded for some distance and were able at various times to observe almost the entire Basin into which we were going. Particular attention was paid to the evidence of spot fires

below the line for future reference after the crew had started to work. At that time no spot fires were seen below the fire line and beyond that portion of the line patrolled by the Park Service men. The fire in general was very quiet and gave every indication that the job of control would be very simple and could be accomplished within a short time. Proceeding on along the fire line, we contacted men of the BPR crew. These men had constructed a remarkably good piece of work, good wide clearing, a very clean trench and were working very rapidly. I stopped a minute with them and told them my plans and that I would come back and contact them later.

We started dropping CCC men for line construction a short distance beyond the BPR crew. I would say not over 200 feet from the beginning of our line construction, we crossed a rocky draw with a small trickle of water. This draw was running northwest. One man was detailed to remain in this draw and build a dam 2 feet high to impound water for back pack pumps and he was to follow up the line as soon as he completed the job. From this point ascending the bank on the opposite slope, we were able to go in a southeasterly direction very near the top of a small ridge through very scattered timber free of duff and down logs. There was very little brush. In fact, fire line construction was very simple at this point. The main fire was only a few feet away to our right. This opening was followed until we reached fires which made it necessary for us to go almost at right angles to that line. Dropping down and crossing another draw which afforded the same conditions on the opposite bank as the first draw. Water was also noted in this second draw, a few feet below where our line crossed it and under a small ridge. I remember calling Tyrrell's attention to this water and remarking how fortunate we were to have water available that far from any pack horses.

This second draw was getting close to timber line and had evidence of either heavy run-off or cloud bursts or water spouts running down. It was within an average of 4 or 5 feet deep and 6 feet wide, and was absolutely swept clean of all inflammable material. This was running in a northwest and southeast direction. I called Tyrrell's attention to the condition of this draw and told him that part of our fire line was already built, that we would use this draw up the country until we had to leave it to corral any fire to the left of it. It was only a few feet to the left of where the fire was burning. At this point the fire was still in the condition that we first noted, no top fires, very little smoke and activity, although there were a number of large spots of trees still unburned, within the main fire. The fire was barely creeping down hill. Our fire line was mostly within a few feet of the blaze. However, we were taking advantage of natural fire breaks in order to complete our line as quickly as possible.

Spot fires to the northeast of the burned over ground made it necessary for the construction of fire trench almost at right angles to the line of the draw, proceeding toward the timber line. Up until this time no wind was in evidence. Almost like a shot out of a gun, there was a heavy wind. It swept through the area in as near as I can determine a northeasterly direction, this carried sparks over the constructed line and below us. I heard a fire roar to the northwest and it appeared to be a considerable distance away. I called to Tyrrell and told him that something was going wrong and that I was going to investigate.

I ran for some distance to the northwest and climbed a rocky point and saw below me a spot fire of considerable size burning to the northeast and around a ridge to the north of us. My impression was that this fire should be immediately taken care of and possibly abandon work on our line in order to do it.

I turned to summon help for this job when there was a decided change in the wind again and the spot fire was swept into the southwest directly into the line of men on line construction. In a few seconds numerous fires appeared below the line at the point where the BPR crew in charge of Bert Sullivan were working and where the water mentioned above was noted. Almost at once it was clearly evident that further attempts at line construction in that area was out of the question. I sent out a call for all men to abandon their work and proceed to the ridge to the northeast. This was approximately three o'clock, P.M.

I then ran down toward the men, found Tyrrell, told him to pass the word both ways, up and down the line, for the men to come onto the ridge. At this time a messenger, David B. Thompson, assistant leader, Tensleep Company, arrived with the following note: "Post, We are on the ridge in back of you and I am going down to the spot in the 'hole.' It looks like it can carry on over the ridge east and north of you. If you can send any men, please do so, since there are only eight of us. Clayton."

Since we were trying to retreat with the whole company, and it was in my judgment certain death for a man to return to the west, this request was not complied with. It was very evident that at the time Clayton wrote this note the wind had not risen and that if he had started to the spot fire mentioned, he would have been down in the canyon, out of sight of the fire and could not have known the exact conditions that followed.

After sending Tyrrell to warn the men, I climbed the ridge to the northeast to where I could observe the spot fire more closely. It seemed to take a long time for the men to straggle up the hill out of the canyon. My recol-

lection is that the BPR party was among the first to reach the bare ridge and in the discussion with Mr. Sullivan, we agreed that provided the crew got out in the next few minutes to where we were, that it would be an easy matter for us to retreat down the ridge to the northwest and just north of the spot fire that was doing the damage and get beyond all fire without any question.

We walked the ridge and called and tried to impress upon the boys the seriousness of the situation and their need for haste. By the time Mr. Tyrrell reported all the men out of the hole that he was able to get any trace of or notify, the wind had changed several times. Spot fires were in evidence north of the ridge we were on. The main fire was traveling in a northeasterly direction toward timber line. All possible chance of escape was cut off to the north and west. The area in the vicinity of the water hole was all ablaze, and consulting Mr. Tyrrell, BPR leader, and Bert Sullivan, we agreed that our only possible chance of escape lay in the direction of the timber line. We immediately ordered all men to drop all heavy tools, back pack pumps, and carry only lanterns, the light lady shovels, and Pulaski tools, and make all possible speed up the ridge in a southeasterly direction to the timberline.

When we reached the last park, almost at timber line, the fire had entered the short neck of timber between us and timber line. In traveling up the ridge toward timber line, Mr. Sullivan and the men of the BPR took the lead. Mr. Tyrrell and myself were in the rear of the column, urging the boys on. Sullivan was requested to size up the situation as he went and try by all means to get above timber line. When we reached the park below timber line and found we were cut off, the men were nearly exhausted from the climb out of the canyon. At this time the canyon to the north was still open to us but there was an abrupt drop from the top of the ridge for a distance that could not be determined on account of the cover. We could see a large open rock slide to our northeast and a possible exit above timberline through a gap but after an examination of the crew, it was decided against taking a chance on going into that hole on the assumption that a spot fire might show up and that we had no means of knowing about and possibly make a trap.

We were able to gain a few minutes' rest on this rock ridge, or open park, before the timber to the south crowned. By climbing down the steep north slope of the ridge we were afforded fairly good protection from this crown fire from the south with the exception of sparks dropping and setting fire to our clothes. The boys showed considerable restlessness at this time and we were continually warning them to lie still, not disturb any

rocks that would roll on ayone and make him lose his footing, and to watch each other's clothes for fire.

This blast produced spot fires in the canyon just mentioned, to the north of us, which showed us that our judgment was right in staying out of that trap. Sullivan and Tyrrell and myself crawled to the top of the ridge and all agreed that that crown fire was possibly the thing that was going to save us because if the wind held in its present direction and didn't sweep around in the canyon to the north that that first burn would be cool enough for us to retreat into when the other would let go. As soon as we were convinced that the smoke from this fire was not dense enough to cause trouble with breathing, we moved the men from the north side of the ridge over the south side, explaining to them what was likely to happen and what they should do when it did happen. We cautioned them and we told them that we might have a pretty tough time but if we stood a chance anywhere in the country it was there and regardless of what happened they were to stand hitched and lie flat on the ground. It was emphasized that they would have no hope of reaching safety through the burn and apparently they agreed. But a very few minutes elapsed between our move and the crowning of timber to the northwest, down to the ridge and in the canyon to the north. The park was swept by a sheet of flame and I have no way of estimating its duration. Nearly all the boys grew panicky and instead of lying down as instructed, a good many of them stood up and ran to the edge of the park, turned and came back. Some of the boys did not listen to any orders, instructions or cautioning and were insistent upon standing up and saying their prayers.

BPR men, especially Bert Sullivan, were of great value in aiding with the managing of these men and keeping them controlled as much as they did. After the first blast of flame swept the park I do not believe there were over one more short interval that we endured flames. For a considerable period the smoke was so dense that it was very doubtful if some of the men would survive and by this time though, we had convinced them that their only chance was to keep their noses to the ground. The wind was shifting so often that we were soon able to get fresh air at regular intervals and the danger was somewhat lessened. In perhaps an hour the smoke had lifted until we were quite safe from that source and in taking stock of our injuries and conditions generally it was noted that at least one BPR man was missing and one CCC crew leader. There was no way of knowing which way they had gone and it was folly to my mind to search for them in the blaze. We kept this information to ourselves because we thought if the boys learned of it they might grow more unmanageable.

For perhaps an hour after we received our burns the big job was to hold the crew in this park. They were assured that all possible help would be forthcoming as soon as the burn-over cooled, that they could be sure that as soon as we could get through the burn in reasonable safety, some of us would go for help.

Mr. Tyrrell was so badly burned that he was no longer of any help. He was told to lie still and stay on the ground. At sundown, I took Mr. Sullivan and one or two of the BPR men who did not seem to be burned badly and we proceeded slowly down to the fire to try to determine if it was possible to make the trip. After getting into the burn a short distance we found that the ground was quite cool at that point due to its not having any great amount of duff to burn.

We could hear someone calling off in the direction of the fire line we had attempted to construct. We could not get any intelligent answer so concluded that someone must be in danger and that if he was in a condition to enable him to call that surely the smoke was not bad enough but what we could manage. I then sent Mr. Sullivan back with instructions to hold these men on the ridge, light the lanterns when dark came and answer any call that he might hear. The other man, whose name I did not learn, proceeded with me in the direction of the call in the fire burn. We were very near the line when we found a boy lying on his back, badly burned, calling for help and wanting water. We knew that we were within a short distance of the water that we had passed on the way in and the BPR man had a water bag with him so he was left to get some water and do what he could for this boy. I showed him the general direction that I intended to take through the burn and told him that I was going for help. I went only a short distance when I met Assistant Supervisor Kreuger on his way in. I briefly outlined the condition of the men and what was needed to get them out and he replied that he would go back with me through the burn and get help.

After meeting Kreuger we had traveled only a short distance to the west when we observed a pile of bodies in a small draw. We stopped for a brief pause and thought we could count 7. There were back pack pumps with these men. (This is presumed to be the water course where the dam was built on the way into the fire.) Kreuger and I ran through the burn west to the open ridge along side the burn of Friday and went down the trail leading into Blackwater Creek. About a quarter of a mile before reaching Blackwater Creek we met Supervisor Sieker with a party of boys, carrying bedding and lunches on the way in. Supervisor Sieker was clearly relieved when he learned that there were forty or so men on the peak.

I briefly told him the condition of the men and that I thought possibly all except three or four could walk out. I was sure that Foreman Tyrrell and one or two others would have to be brought out on stretchers. Supervisor Sieker told me that they had arranged for doctors, medicine and medical help to be sent in and from the looks of this party and their equipment I would say that he had done a very excellent job of preparing for an emergency that he was not even informed of. He instructed me to continue on to Blackwater Creek where an Army Doctor was available to treat my burns.

To the best of my recollection, one BPR man and one CCC crew leader ran out through the fire from the park. The leader I saw in the F-24 hospital in the ward on Sunday morning. This boy told me that he was the one who broke and ran when the fire hit us.

U. J. Post,
District Forest Ranger.

August 27, 1937.

DEATH COMES TO LLOYD G. HORNBY

On the same day of the catastrophe on the Shoshone, Lloyd G. Hornby died from overexertion on a fire on the Clearwater National Forest in North Idaho. While on his way to a lookout station near the fire he pitched forward between words of a sentence. The men with him thought he had fainted, but it was soon apparent that the end had come from heart failure.

Hornby was just completing his first round of the National Forest Regions after six months in his assignment as Fire Control Specialist directing the recheck of fire planning on all National Forests. His death is not only a grief to his many friends, but pretty well wrecks all plans for National leadership and coordination in the three-year fire control planning project. No successor has been selected.

MAN-CAUSED FIRES IN RELATION TO NUMBER OF VISITORS

DIVISION OF FIRE CONTROL
Washington, D. C.

Man-caused fires on the national forests must obviously be started either by people visiting the forests or by residents living within them. In searching for an understanding of the why of such fires it is worth while to consider variations in number of visitors per fire in different parts of the country. These variations are shown in the accompanying tables.

While no great degree of accuracy should be attributed to the statistics on number of visitors, the gross variations are indicators of what happens in different parts of the country and under varying systems of fire prevention. Promising leads for further study may be found in these gross variations. There is no need to try to draw dubious inferences from small differences in the figures. A few of the more significant comparisons are worth mentioning. All figures on number of visitors are for the fiscal year 1936. In the following comments the figures on number of visitors per fire are all from the second visitors' column—"excluding those merely passing through."

The Pike National Forest attracts attention at once. While fuels are light on the Pike, there is plenty of material in which fires could start and spread. Although summer rains are normal in normal years, it is, nevertheless, a dry country. Mean humidity is low. The number of days per annum in which fires will start and run is probably higher than average for the national forests. *In the face of these conditions only 1 person out of 232,737 is responsible for the start of a reportable fire.* If this figure is discounted 50 per cent, then 1 person out of 116,368 starts a fire. This reduced figure is higher than the next largest—1 fire per 94,292 visitors on the White Mountains, where the climate is relatively favorable.

Part of the explanation is, perhaps, that the total number of man-caused fires is low on both forests. As the number of fires approaches zero the number of visitors per fire loses its significance—or at least assumes a different sort of significance. But the theory that number of visitors per fire means less as number of fires approaches zero has a significance of its own. If after reasonably effective prevention is attained, large increases in number of visitors are unimportant in their influence on number of fires, this is a source of encouragement for prevention planners. Perhaps an increase in number of visitors carries its own safety factor.

There is a challenge in the comparison of the Angeles with many other

forests. There are few safety factors on the Angeles. Days per year in which fires will start and run must be relatively high. Its fuels are of the "tinder box" sort. Low humidity and high fall winds are characteristic phenomena. There is much human use of the forest, which is equivalent to the presence of a large resident population, a much more important factor than visitors in the Gulf States. One fire for each 37,711 visitors on the Angeles stands out as tangible evidence of what can be accomplished under certain conditions.

What can be the explanation of the great difference between the Angeles figure and those for the other southern California forests? How did the Angeles get that way? May the other southern California forests be expected to follow suit? What is there in the way of theory and practice which might be transferred from the Angeles to the Shasta, the experimental fire forest, with its man-caused fire for every 696 visitors?

Close reading of all the man-caused fire figures by forests, together with the corresponding figures on visitors per fire, suggests that number of visitors may easily be over appraised as an explanation of the number of man-caused fires. There are blocks of such figures from which the first inference would be that number of fires vary more directly with area than with anything else. The curious Black Hills and Harney figures point that way. Fuels and weather must be more than usually uniform on these two units. The Black Hills organization could probably prove that it is not because of less prevention interest and effort on that forest than on the Harney that the Black Hills has one fire per 447 visitors.

The new units in Eastern Regions must be regarded as in a class by themselves. Time (but not too much time) must be allowed for getting a response from large resident populations to national forest influence for prevention. But the figures for some of the older eastern units leave something to be desired. For example, if the figures of one fire for each 102 and 60 visitors, respectively, on the Ouachita and Ozark Forests are explained by referring to the large resident populations, then what happens to the reputation these forests have had for success in controlling the fire-starting habits of local people? Two hundred and twenty-five fires for the Ouachita and 265 for the Ozark are not too encouraging. The new areas added to each forest have no doubt had an influence on the figures, but a glance back through the record for the years prior to recent additions shows a disheartening number of man-caused fires.

Man-Caused Fires in Relation to Number of Visitors to National Forests During C.Y. 1936
(Numbers of Visitors are for F.Y. 1936)

Region State & Forest R-1	Total man-caused fires	Average Number of Visitors per Fire: Including those merely passing through	Average Number of Visitors per Fire: Excluding those merely passing through
Montana			
Absaroka	3	36,833	7,833
Beaverhead	4	15,025	7,225
Bitterroot	9	8,711	3,056
Cabinet	58	3,007	376
Custer	13	2,116	870
Deerlodge	28	17,707	8,664
Flathead	24	6,249	770
Gallatin	12	41,433	3,692
Helena	17	12,448	1,507
Kootenai	43	734	294
Lewis & Clark	15	6,380	3,280
Lolo	24	2,460	815
Total (or average)	250	8,127	1,430
Idaho			
Clearwater	7	641	624
Coeur d'Alene	30	1,205	608
Kaniksu	24	2,233	1,050
Nezperce	21	452	229
St. Joe	37	560	322
Total (or average)	139	976	511
Total (or average) R-1	389	5,572	1,101

Region State & Forest R-2	Total man-caused fires	Average Number of Visitors per Fire: Including those merely passing through	Average Number of Visitors per Fire: Excluding those merely passing through
Colorado			
Arapaho	4	164,031	14,507
Cochetopa	14	18,357	1,500
Grand Mesa	3	18,165	14,670
Gunnison	4	6,747	2,095
Holy Cross	7	18,323	4,584
Montezuma	7	36,125	9,621
Pike	9	528,903	232,737
Rio Grande	7	21,714	10,671
Roosevelt	6	126,697	34,652
Routt	5	13,794	3,534
San Isabel	2	48,645	29,208
San Juan	8	5,439	1,200
Uncompahgre	4	5,350	2,004
White River	2	42,982	9,568
Total (or average)	82	89,820	35,182
Nebraska			
Nebraska	1	6,090	740
South Dakota			
Black Hills	34	3,976	447
Harney	46	3,686	2,805
Total (or average)	80	3,809	1,803
Wyoming			
Bighorn	10	21,904	4,874
Medicine Bow	16	20,644	4,437
Shoshone	2	33,802	13,188
Washakie	3	7,987	2,120
Total (or average)	31	20,674	4,919
Total (or average) R-2	194	42,871	15,559

Region State & Forest R-3	Total man-caused fires	Average Number of Visitors per Fire: Including those merely passing through	Average Number of Visitors per Fire: Excluding those merely passing through
Arizona			
Apache	12	7,375	958
Coconino	57	3,825	647
Coronado	19	6,739	5,849
Crook	8	58,415	4,581
Kaibab	46	31,377	599
Prescott	36	20,742	1,186
Sitgreaves	25	1,456	336
Tonto	9	14,955	8,043
Total (or average)	212	15,391	1,801
New Mexico			
Carson	11	14,084	1,403
Cibola	25	9,872	3,280
Gila	13	9,308	1,615
Lincoln	10	35,798	4,088
Santa Fe	4	24,500	9,250
Total (or average)	63	15,555	3,128
Total (or average) R-3	275	15,424	1,981

(1) Where Forest is located in more than one State, figures are included in State in which greater portion lies.

(2) Number of visitors are for F.Y. 1936.

(3) Number of fires are for C.Y. 1936.

Man-Caused Fires in Relation to Number of
Visitors to National Forests During C.Y. 1936
(Numbers of Visitors are for F.Y. 1936)

Region State & Forest R-4	Total man-caused fires	Average Number of Visitors per Fire: Including those merely passing through	Average Number of Visitors per Fire: Excluding those merely passing through
Idaho			
Boise	57	374	280
Cache	40	6,167	3,240
Caribou	0	(28,780)	(20,350)
Challis	14	1,791	674
Idaho	49	639	149
Lemhi	3	10,390	6,623
Minidoka	10	3,745	7,513
Payette	27	7,423	1,665
Salmon	14	446	359
Sawtooth	14	2,583	1,808
Targhee	27	8,456	2,967
Weiser	45	1,663	358
Total (or average)	300	3,257	1,323
Nevada			
Humboldt	12	687	358
Nevada	1	81,470	22,930
Total (or average)	13	6,645	2,095
Utah			
Ashley	3	11,050	10,110
Dixie	9	12,038	7,667
Fishlake	3	70,790	28,653
La Sal	0	(4,440)	(2,800)
Manti	1	48,400	48,400
Powell	2	52,850	2,600
Uinta	5	41,806	16,428
Wasatch	32	18,179	9,527
Total (or average)	55	23,676	11,235
Wyoming			
Teton	0	(207,840)	(40,000)
Wyoming	9	3,948	2,381
Total (or average)	9	27,013	6,826
Total (or average) R-4	377	6,927	2,926

Region State & Forest R-5	Total man-caused fires	Average Number of Visitors per Fire: Including those merely passing through	Average Number of Visitors per Fire: Excluding those merely passing through
California			
Angeles	35	198,118	37,711
Cleveland	33	19,774	4,630
Eldorado	60	6,657	2,341
Inyo	11	31,096	9,743
Klamath	75	321	211
Lassen	68	5,266	1,121
Los Padres	25	93,224	3,992
Mendocino	31	655	506
Modoc	75	3,635	403
Mono	11	16,291	13,200
Plumas	163	706	338
San Bernardino	82	89,358	8,984
Sequoia	33	15,106	5,278
Shasta	128	9,909	696
Sierra	47	11,455	2,298
Stanislaus	38	12,474	2,816
Tahoe	140	10,250	1,893
Trinity	54	1,391	368
Total (or average) R-5	1,107	81,010	5,305

Region State & Forest R-6	Total man-caused fires	Average Number of Visitors per Fire: Including those merely passing through	Average Number of Visitors per Fire: Excluding those merely passing through
Oregon			
Deschutes	40	5,062	1,305
Fremont	21	673	506
Malheur	45	315	248
Mt. Hood	56	18,554	4,985
Ochoco	25	604	196
Rogue River	24	5,464	1,656
Siskiyou	92	4,213	503
Siuslaw	104	11,704	3,607
Umatilla	54	905	283
Umpqua	20	2,677	2,023
Wallowa	21	2,033	1,033
Whitman	97	571	206
Willamette	31	6,086	2,378
Total (or average)	630	5,367	1,452
Washington			
Chelan	19	1,063	954
Columbia	11	65,350	2,136
Colville	40	636	342
Mt. Baker	22	3,666	3,566
Olympic	14	6,118	4,495
Snoqualmie	33	43,463	5,970
Wenatchee	23	105,384	6,782
Total (or average)	162	28,066	3,292
Total (or average) R-6	792	10,010	1,963

(1) Where Forest is located in more than one State, figures are included in State in which greater portion lies.

(2) Number of visitors are for F.Y. 1936.

(3) Number of fires are for C.Y. 1936.

(4) In Region 4, for Caribou, La Sal and Teton total number of visitors is given.

Man-Caused Fires in Relation to Number of Visitors to National Forests During C.Y. 1936
(Numbers of Visitors are for F.Y. 1936)

Region State & Forest	Total man-caused fires	Average Number of Visitors per Fire: Including those merely passing through	Average Number of Visitors per Fire: Excluding those merely passing through
R-7			
New Hampshire			
White Mtn.	5	916,791	94,292
Pennsylvania			
Allegheny	31	44,562	2,114
Vermont			
Green Mtn.	3	140,106	1,923
Kentucky			
Cumberland	469	26	(.4)
Virginia			
Geo. Washington	51	17,170	1,417
Jefferson	114	440	112
Total (or average)	165	5,611	515
W. Virginia			
Monongahela	35	9,429	857
Total (or average) R-7	708	10,810	929
R-10			
Alaska			
Chugach	17	282	135
Tongass	23	3,065	2,561
Total (or average) R-10	40	1,882	1,520
TOTAL (OR AVERAGE) WESTERN REGIONS	3,174	15,318	3,264

Region State & Forest	Total man-caused fires	Average Number of Visitors per Fire: Including those merely passing through	Average Number of Visitors per Fire: Excluding those merely passing through
R-8			
Alabama Forests	28	752	332
Arkansas			
Ouachita	225	1,078	102
Ozark	265	124	60
Total (or average)	493	559	79
Florida Forests	105	2,442	265
Georgia			
Chattahoochee	53	3,012	927
Louisiana			
Kisatchie	796	12	8
Mississippi Forests	897	1,020	7
North Carolina			
Croatan	86	241	9
Nantahala	117	1,564	453
Pisgah	121	4,394	581
Uharie	16	7	7
Total (or average)	340	2,163	365
South Carolina Forests	263	1,023	92
Tennessee			
Cherokee	125	7,245	625
Texas Forests	709	17 (3)	17
Total (or average) R-8	3,809	954	99
TOTAL (OR AVERAGE) R-7-8-9	8,490	2,463	160

Region State & Forest	Total man-caused fires	Average Number of Visitors per Fire: Including those merely passing through	Average Number of Visitors per Fire: Excluding those merely passing through
R-9			
Illinois			
Shawnee	282	3,944	266
Indiana			
Hoosier	115	14,510	14
Michigan			
Hiawatha-Marquette	97	5,976	409
Huron	31	5,492	1,089
Manistee	216	2,537	106
Ottawa	59	4,084	1,202
Total (or average)	403	3,819	415
Minnesota			
Chippewa	101	4,174	726
Superior	68	4,516	890
Total (or average)	169	4,312	792
Missouri			
Clark	1,716	134	14
Gardner	1,082	946	16
Total (or average)	2,798	448	15
Ohio			
Wayne	67	61,014	268
Wisconsin			
Chequamegon	41	3,173	645
Nicolet	118	823	197
Total (or average)	159	1,429	313
Total (or average) R-9	3,973	2,443	185
GRAND TOTAL (OR AVERAGE)	11,664	9,974	1,020

(1) Where Forest is located in more than one State, figures are included in State in which greater portion lies.

(2) Number of visitors are for F.Y. 1936.

(3) Number of fires are for C.Y. 1936.

(4) In Region 8, for Texas Forests, no number of visitors passing through is given.

TEMPORARY TOWERS FOR VISIBLE AREA MAPPING

By R. M. BEEMAN

Junior Forester, Jefferson National Forest

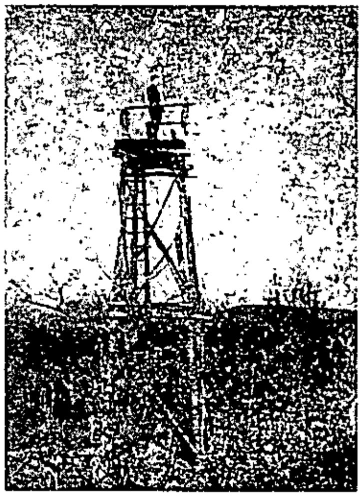
The primary data in the formulation of a detection plan are visible area maps for every possible lookout point in the district. Unless topographic sheets are quite accurate and the point to be considered is an abrupt peak, a visible area map made in the office by profiling will prove decidedly unreliable. Ordinarily, the map must be drawn in the field, and satisfactorily accurate field mapping involves use of the plane table.

The mapper requires a relatively unobstructed view in all directions. Often, however, a point will be so densely covered with timber or brush that even a combination of several set-ups will not provide complete coverage. When this is not obtainable from the ground, the following alternatives are suggested:

First, one or several trees may be climbed. In the East this can often be accomplished without spurs. Where a satisfactory map can be obtained by its use, this method is desirable, as it involves no damage to either timber or aesthetic value. The difficulty of maintaining a map board in a level, oriented position and of using an alidade, while perched precariously in a waving tree top, precludes accuracy. An unusually skilled and experienced man can produce a good sketch under these conditions. However, when use of the plane table checked by duplicate mapping by an experienced man has proved only about 85 per cent correct, it appears desirable, when practicable, to provide the mapper with ample assistance. The final detection plan can be only as reliable as the visible area maps upon which it is based.

Two methods facilitating use of the plane table have been employed on the Jefferson National Forest: (1) cutting the timber, and (2) building a temporary wooden tower. The former is applicable if the timber value is low, and if the point in question rises sharply above the surrounding terrain. On the newer purchase units it often involves obtaining permission from the owner or owners before cutting. Sometimes, even though the trees have little value for timber, permission is not granted. Also, a point on a level ridge or in gently sloping terrain would require an enormous amount of clearing. Despite these limitations, cutting has proved applicable to a limited extent: The mapper is accompanied by a four- or six-man felling crew which clears out such areas as he directs. By clearing the least obscured sector first, mapping starts early in the day, and one trip to the point is sufficient.

District Ranger J. N. Van Alstine has developed a wooden tower which has proved eminently satisfactory for plane-table visible area mapping in country characterized by level ridges covered with scrubby oak and hickory. The tower (see illustration) is constructed of material cut in the vicinity. It is formed of 4 legs—one of which is a living tree, topped and trimmed—horizontal and vertical braces, a plank platform 5 feet square, a railing 3½ feet above the platform, a ladder up alongside one leg, a fifth, minor leg serving as the other member of the ladder, all put together with 60-penny nails. Use of a living tree as one member adds to rigidity and durability. The plank platform and railing enable the mapper to set up his tripod and proceed as on the ground. Supplies to be carried in are 2-inch plank for platform, nails, axes, hammers, crosscut saws, tree climbers, pulleys, and rope.



A crew of 10 CCC men can erect such a structure in 2 days. Greatest height to date is 33 feet. Increased height involves decrease in stability and entails handling increasingly heavier pieces; over 40 feet would prove impractical for a structure of this type. Use of the tallest straight oak or hickory at the highest point of the mountain as one leg usually insures sufficient height; if it does not, a tower on each side of the crest may be necessary.

The cost of constructing such a tower is: labor and supervision, about $40; materials, negligible. If the first described method, that of cutting the timber, is employed, costs will obviously be proportioned to the amount to

be felled. The largest crew used on the Jefferson was 6 men, as the mapper served also as foreman, and both clearing and mapping were completed in one day. The cost was the daily wage for 6 men, or about $9. The timber-cutting method is apparently the cheaper, and is recommended upon two conditions: that the value or extent of the timber is not so great as to make costs exorbitant, and that it is not anticipated that the peak in question will be used as a secondary lookout within the next 5 years. Bearing these two qualifications in mind, the detection planner will no doubt find that tower construction is sometimes indicated.

A network of these temporary towers, in addition to providing facility for visible area mapping and thus the foundation for a sound detection plan, will also serve during hazy weather as the nucleus for the secondary lookout system. The 5-foot square plank platform is ample for installation of a simple alidade and its manipulation by the observer, although high winds may necessitate occasional check on orientation. Lightning protection will probably prove desirable, and lack of shelter will be a handicap during rough weather. For secondary use, however, this type of structure appears to merit consideration.

POWER LINE FIRES IN REGION 5 AND THEIR PREVENTION

By C. A. Gustafson

Assistant Chief, Fire Control, Region 5

During 1935 the Forest Supervisors of Region 5 were requested to send in a report on all fires attributed to power lines during the past several years. The Plumas Forest submitted an 18-year record; Los Padres (formerly Santa Barbara), Sequoia, Sierra, and Trinity Forests a 14-year record; the Angeles, Lassen, San Bernardino, and Stanislaus a 10-year record; the Tahoe a 7-year record; and the Eldorado and Shasta a 4-year record. No fires from power lines had occurred on the Modoc, Mono, Inyo, Mendocino, Klamath, and Cleveland Forests. The report is up to and including the season of 1934.

Following is the number and area of fires attributed to different phases of power line failures:

Cause	Number of Fires	Per Cent of Fires	Area Acres
Flashover	3	6	12
Fallen poles or towers	2	4	37
Power pump and telephone line	1	2	....
Broken power lines	9	18.5	22,484*
Faulty insulation	8	16.5	300
Fallen trees or snags	13	27	3
Birds	2	4	....
Improper clearance	5	10	3,553†
Current turned on by mistake	2	4	....
Power shorts	2	4	....
Burning fuses	1	2	640
Blasting	1	2	....
Total	49	100	27,029

Out of a total of 26,034 acres attributed to broken transmission lines, 22,180* acres was the result of the Lower Sesar fire on Los Padres (Santa Barbara) Forest during 1929.

Out of a total of 3,553 acres attributed to improper clearance, 3,550† acres was due to the Brown Mountain fire on the Angeles during 1934.

Most transmission lines operate under licenses from the Federal Power Commission. The licenses issued for their lines generally have standard stipulations in them which empower the Forest Service to exact certain fire preventive measures from the operating company for lines traversing Government lands. These stipulations when briefed bring out the following factors which can be interpreted as tools to be used by the Forest

Service in requiring the power companies to operate their lines in such a way that the possibilities of fires starting are reduced to a minimum:

1. Licensee shall clear and keep clear to adequate width its lines on United States land to the satisfaction of representatives of the Federal Power Commission.

2. Licensee is liable for injury to or destruction of buildings, roads, lands, or other United States property occasioned by the construction, operation, or maintenance of the project.

3. Licensee shall do everything reasonably in its power, and require its contractors to do everything independently and upon request of the United States representatives, to prevent and suppress fire on or near lands occupied under license.

4. Licensee shall maintain projects in adequate, efficient, and safe operating condition.

Referring back to the past history of fires due to power line occupancy, the prevention of fires may be accomplished in the following manner:

Fires Due to Flashovers

Fires from flashovers are the result of transmission lines swinging together when the spans are too long. In such cases additional towers or poles should be installed in order to reduce the length of span. This can be required under stipulations 3 and 4.

Fires Due to Fallen Poles or Towers

When fires occur because of fallen wooden poles, usually the pole has rotted at the ground line. Forest officers during the yearly inspection of transmission lines should carefully observe the poles near the ground line, noting which poles have rotted to a considerable extent, and report their findings to the power company.

Failure of steel towers generally occurs only during winds of extraordinarily high velocities or because the design of the tower is not in keeping with the conditions under which it is expected to operate.

With regard to both wooden poles that have rotted at the base sufficiently to constitute a hazard and poorly designed towers, licensees can be required to replace them under stipulations 3 and 4.

Fires Due to Power Pump and Telephone Line

Fires due to power pump and telephone line are either the result of poor maintenance or improper construction. If after examination of the line such conditions are found, the licensee can be required to remedy them under stipulation 4.

Fires Due to Broken Power Lines

The design and subsequent construction of transmission lines take into account the necessary mechanical strength of the line to withstand the weather conditions prevalent in the locality of the line. Possibility of a coating of ice on the conductor and wind pressure to a large extent determine the mechanical strength necessary in the line.

Where conductors have been breaking with more than very occasional frequency it is evident that the design of the line will not withstand the loading conditions which obtain in the locality. In such cases, upon proper showing, the licensee can be required, under stipulation 4, to reconstruct its line so as to make it safe under existing operating conditions.

Fires Due to Faulty Insulators

Insulators have probably the highest depreciation rate of all equipment used in transmission lines. Most companies test insulators on their lines once every five years. If fires have been occurring from this cause at more than rare intervals, forest officers should check to determine if the company has tested its insulators recently. If not, the licensee can be required, under stipulations 3 and 4, to test insulators and to replace those found to be faulty.

Fires from Fallen Trees or Snags

Stipulation 1 requires the licensee to keep clear to adequate width its lines on United States lands to the satisfaction of a representative of the Federal Power Commission.

No uniform policy can be established with regard to clearing because of the many variations in cover and topography along power lines. All forests, however, should make an annual survey, preferably with a representative of the operating company, to determine the clearing requirements necessary. They should look for insufficient clearance that might result in fires starting.

Clearing around poles should be of sufficient radius to catch falling insulators. Clear 10 feet in radius for lines of 11,000 volts and less, and a minimum of 20 feet around higher voltage lines.

Need for complete clearing of right-of-ways to specified widths throughout the entire distance across national forest land should be required only when the forest officer can show it is a reasonable and worth-while requirement. The width should be kept as low as will meet the needs.

Fires Caused by Birds

Little can be done to reduce fires caused by birds. Some companies have

installed bird guards on their transmission lines. However, the stipulations do not generally contain this requirement.

Fires from Improper Clearance

This type of fire is entirely due to faulty design or inadequate clearing. On national forest land the licensee can be required to remedy the fault under stipulations 1 or 3.

Fires Due to Current Turned on by Mistake

This type of fire is entirely inexcusable from the standpoint both of safety to life and fire protection. Where such a fire occurs it should be brought to the attention of the licensee, since the power companies are as anxious as the Forest Service to prevent such errors.

Fires Due to Power Shorts

Several factors may be involved in power shorts, such as faulty insulators, fallen trees, improper clearance, etc. Corrective measures can be required under the stipulations set forth for these causes.

Fires Due to Burning Fuses

Fires caused by burning fuses can really be considered inexcusable, because it is very poor practice to use the open type of fuse where there is a fire hazard. When inspections of transmission lines are made, forest officers should be on the alert to discover the use of such fuses. In localities having a fire hazard, a licensee, under stipulations 3 and 4, can be required to use the enclosed type of fuse of non-inflammable nature where it will function.

Fires from Blasting

Blasting on Forest Service or other construction projects within the forest protection area should be done with extreme caution, particularly when in the vicinity of transmission lines. Continued vigilance on the part of forest officers will do much to reduce possible fires from this cause.

General

It can readily be seen, when studying transmission line fires, that thorough inspection of all lines traversing national forest areas must be made annually, followed with a written report to the company giving the measures to be taken to bring their lines up to the operation standards that will prevent fires from starting.

RAILROAD FIRES

By C. A. Gustafson

Assistant Chief, Fire Control, Region 5

Railroad fires have been a constant threat to national forest protected areas in Region 5 ever since national forests were established. The trend of these fires, as shown by the following figures, does not indicate that prevention efforts have paid very big dividends.

The number of fires attributed to railroads are 21, 22, 12, 25, 47 and 71, respectively, for the years 1931 to and including 1936, or a total of 198 fires from this cause for the six-year period.

The area for the same period is 760, 90, 241, 2,203, 781, and 22,854 acres, with a damage figure of $416, $20, $206, $9,312, $758, and $38,704, respectively.

A breakdown of railroad fires into specific causes shows, in order of importance, that brake shoes, engine sparks resulting from indiscriminate sanding, discarded burning waste, fusees, and right-of-way burning are responsible for most of these fires.

When studying these causes with the view of effecting specific prevention measures, the following data are noted:

Fires Caused by Brake Shoes

It is found that most, if not all, of the brake-shoe fires occur on down grades. The "tight" schedule under which the trains operate, the large tonnage of both the passenger and freight trains, and the excessive grades (up to 2.8 per cent) necessitate heavy braking to slow down for the many curves in the canyons, or to stop when it is necessary to "pull" into a siding. This heavy braking causes the tires and brake shoes of the locomotives and the wheels and the shoes of other rolling stock to become so overheated that red-hot material, weighing as much as 2 or 3 pounds, sloughs off. Many specimens of brake shoe tire, and wheel scale have been found at the point of origin of a fire, in some instances as far as 16 feet from the outside rail. The fusion of this scale, which could occur only when the metal was so hot that it would "run," forces us to believe that numerous fires have been caused by this hot material.

Removal of all inflammable material for a safe distance from the track will eliminate this type of fire.

Engine Sparks (Indiscriminate Sanding)

Engine sparks seem to be a constant cause of fires. My three-years' experience as a locomotive fireman leads me to believe that these fires are probably caused by a process known as fine sanding of the engines while running. Fires originating in this way occur on the upgrades or when the engine is under heavy labor, thereby causing sufficient draft through the stack to draw the sand from the firebox through the boiler flues. An engine is rarely sanded on down grades unless it is put under a full throttle to create sufficient draft through the stack.

Clearing to make sanding safe any place along the right-of-ways is economically impossible, since the distance to be cleared is too great; also it is entirely unnecessary. There are several things, however, which may be done to prevent fires from this cause:

1. Proper equipment of locomotives with spark arresters and periodical inspection to make sure they are in good operating condition.

2. Survey, in company with local railroad officials, to determine where sanding is usually necessary and provide for changing such locations if the cost of reducing the hazard is too great.

3. Make plans with the officials at the time of survey to have the hazard reduced along sanding lanes. This should be done to a distance of 200 feet each side of the outer rail.

4. Work to get railroad officials to issue instructions to their engine men to "sand" only at the approved locations.

5. Get the company to mark the location where sanding may be done so the engine men can readily recognize them and clean the engine flues when passing through these lanes.

Fusee Fires

Fusees are often lighted and thrown from moving trains as a warning for trains following. When so thrown they very often fall in the center of the track, but sometimes they roll or bounce to the side, where the flames come in direct contact with dry grass or other fuel and ignite it. The old type of fusee was equipped with a spike which permitted it to be stuck upright on a tie, thereby greatly reducing the danger of fire, as the "off-fall" from a burning fusee will not usually set a fire when it is in the upright position.

In my opinion, based on observation and experience, the spike-type fusee would materially reduce the possibility of fires from this cause, since, as a conservative estimate, I should say that at least 50 per cent of them would

stick upright if properly thrown from moving trains, and would always stick if placed by a flagman on the ground. Many railroads at the present time, however, are using a spikeless type of fusee which was recently approved and adopted by the American Railroad Association as standard.

Four means of preventing fires from this cause are:

1. Hazard reduction work along the railroad right-of-ways.
2. Using the spike-type fusee.
3. Written instructions by railroad officials to their men to be careful in the placement of the fusee.
4. Contacts with Railroad Brotherhood members to secure their cooperation with respect to fusees.

Fires from Discarded Lighted Material

Fires caused by discarding lighted material, such as burning waste, cigarettes, matches, etc., and, in the case of coal-burning locomotives, kicking from the engine deck hot clinkers that have been pulled from the firebox, are really inexcusable. Forest officers should seek to get railroad companies to issue positive and mandatory instructions to their employees forbidding this practice. In this connection forest officers should also arrange to appear before various Brotherhood meetings from time to time for the purpose of impressing their members with the necessity for their full cooperation in this connection.

Right-of-Ways Hazards Fire

Fires starting from burning right-of-ways are usually the result of:

1. Inadequate advance planning by the railroad companies.
2. Insufficient manpower to handle the work.
3. Inadequate, or lack of, patrol.
4. Burning during period of high hazard.
5. No inspection of burning operations prior to or during burning by forest officers.
6. Insufficient equipment.

To make sure that fires do not start from burning right-of-ways, forest officers should check all the points listed and take such steps as their inspection shows to be necessary to prevent the possibility of fires following this work.

In summary, the forests of Region 5 are taking the following steps to reduce fires caused by the operation of railroads.

1. When new construction is on national forest land or where the projection of new trackage is contemplated, fire prevention stipulation as to

hazard reduction, equipping machines with spark arresters, etc., are written into the permit.

2. Railroad crews are being dispatched to suppress railroad fires whenever possible.

3. If Federal property is damaged, or where the Forest Service expends Federal funds to suppress such fires, adequate trespass settlement is asked of the railroad company.

4. Annual surveys of hazards are being made in advance of the fire season, on railroad right-of-ways by mile posts, with specific recommendation of control work to be done and estimate of cost to the company. This survey is submitted to the company officials for action, with definite recommendations as to plans, dates, etc., in advance of the fire season and previous to the submission of budget estimates by the railroad maintenance department. Technical advice is given and incidental supervision on actual jobs is planned by the Forest Service.

5. Recommendations to the company regarding adequate spark arrester installation, sanding lanes, etc., are made and followed up to see that they are carried out.

6. Meeting with railroad train and engine men and company officials to secure their cooperation in preventing fires.

The work being done by the forests will, we feel, bring results. One company, this spring, budgeted $6,000 for hazard reduction, something it never did before; while another company has set up sufficient funds to employ a 35-man hazard reduction crew equipped with two trail builders and other necessary tools. One other company plans on completing the major track maintenance job in a hazardous canyon prior to the fire season.

We feel that, as the season advances, the efforts of Region 5 in reducing railroad fires will bear fruit and that next fall the records will show a smaller number of such fires.

LAW ENFORCEMENT AS A PREVENTION MEASURE

By G. L. Fraser

Fire Prevention Officer, Region 5

Law enforcement has taken its place as an essential part of the fire prevention program in Region 5. The effectiveness of our efforts are particularly reflected in the reduction of disastrous incendiary fires occurring annually on national-forest land. The records show a steady decrease from 134 incendiary fires in 1931, with an area of 50.440 acres burned and damage estimated at $179.030, to 28 incendiary fires in 1936, with an area of 1,688 acres burned and damage estimated at $5,803.

This marked reduction is not solely attributable to law enforcement. There are many other contributing factors. *i. e.*, improved detection, communication, and transportation facilities, improved training of fire-fighting forces, improved fire-fighting equipment and, last but not least, the almost exclusive use of CCC labor for fire-fighting purposes. CCC labor has in no small degree discouraged the setting of fires to create jobs.

It is regrettable that no yardstick has yet been devised by which we can accurately and independently appraise the exact prevention value derived from each of the factors mentioned. However, the effect of law enforcement has become increasingly apparent by the changed attitude of the incendiary elements in the mountainous areas. Loud and boastful talk about malicious burning is no longer heard. Rarely do we now meet with the statement from suspects in fire cases: "You can't prove that I set the fire unless you can produce an eye witness. Simply because you found my tracks at the fire does not prove that I set it." They know now that such proof can be made and that prosecution will be instituted whenever circumstances justify it.

Changed their minds, you say? Well, not exactly!

Experience has shown that in most cases the value of burning to the confirmed burner lies in his conception of the benefits he derives from a grazing, mining, or hunting standpoint. He is not interested in any explanation to the contrary, nor in the disastrous consequences that follow ill-advised burning. In all probability we will never be able to convert this type of burner. We can never take out of his heart and mind that desire to burn. However, experience has convinced us that we can counteract or neutralize that desire by convincing him that rigid prosecution is sure to follow any violation of the fire laws. That is prevention the hard way, but it seems to be the best way to successfully handle that type of individual

Region 5's record of approximately 35 felony cases successfully prosecuted in Federal Courts during the last two seasons is very encouraging, since circumstantial evidence is usually the only evidence obtainable. After all, circumstantial evidence, when properly prepared and presented, is often more convincing to a jury than direct evidence furnished by uncertain witnesses.

In practically every case there is some evidence on the ground at or near the origin of an incendiary fire. Someone has been there to set it, either by direct or indirect method, and has left some evidence of his presence. Our ability to detect and interpret that evidence enables us to make a start.

While it is generally conceded among forest officers that suppression of a fire is paramount to all else, the prevention angle should not be overlooked. If the cause is not determined and the perpetrator called to the bar, there will in all probability be other fires from the same cause. Therefore, the investigation is as important as the suppression. If the investigation is not started at once, evidence on the ground may be obliterated either by the suppression crew or by the fire itself. It is a common and effective practice in this Region to have one man on each suppression crew assigned to the task of searching for and preserving any evidence on the ground. He is the first man to hit the trail when the fire truck stops. He goes ahead of the crew to search for clues. If he finds tracks he covers them in order to protect them. If possible, and circumstances will permit, he may build a fire line around them to prevent their being burned over until such time as a plaster cast can be made of them. Materials for making casts are carried as part of the equipment of each suppression crew.

Tracks

Tracks are among the most important clues. If a fire is set or other offense committed by human agency, someone must have walked or ridden to the scene to do it. He may cover up his tracks in the immediate vicinity of the offense or they may be burned over or otherwise obliterated before the investigator arrives. If no tracks can be found at or near the origin, it is necessary to widen out in circular fashion until the tracks are picked up. If the tracks, when found, indicate that the suspect has ridden away in a car, plaster of paris casts should be made of the tire tracks for future identification. If travel by foot or horseback is apparent, casts should be made of the best tracks found nearest to the fire.

Extreme caution is used in following horse or man tracks out; and all loops, detours, or short cuts are closely traced, even though the identity of the person suspected is fairly certain. The urge to go direct to his home for the purpose of questioning him is firmly suppressed. The investigator can

then truthfully and conscientiously testify as to the route taken by the suspect. If the suspect, or his horse, is overtaken, even though the suspect may make an admission of his guilt and signify his willingness to plead guilty, the precaution should be taken to secure another cast of the track followed from the fire. In case of a man track, the shoes are seized for use in the event trial becomes necessary. Shoes can be legally seized by consent of the owner or by authority of a search warrant. Sometimes a little diplomacy on the part of the officer will eliminate the necessity of obtaining a search warrant.

Experience has shown that casts of tracks when properly connected up are the best circumstantial evidence we can obtain in a fire case. Testimony is always strengthened by something material to present to a jury—something they can look at and compare for themselves.

If the officer is not a trained tracker—few people are—it is best to secure the services of one or more experienced trackers whose experience, when related in court, will suffice to qualify them as experts in the eyes of the court. Caution is used in such a selection to avoid the possibility of employing a tracker whose efficiency might be impaired by personal acquaintance or friendship in the community which might cause him to intentionally lose the track once he becomes convinced it is leading toward the home of some friend.

Fingerprints

Few people are acquainted with the value of fingerprints as evidence. They are very valuable where they can be obtained, give absolute identification, and are easy to use. They are produced by the oily impression of the minute ridges on the surface of the skin, and are left even when the hands are clean, although very faint when the skin is dry or immediately after washing it with soap. Fingerprints may be found on anything a man handles which has a reasonably smooth surface, such as papers, cans, bottles, tools, guns, etc. They can be developed or made visible by applying a very fine powder, known as fingerprint powder, which, when brushed or sprinkled on lightly, will adhere to the ridges of the pattern of the print. The surplus powder is shaken off or blown away, leaving a fairly plain impression. It is then photographed for later comparison and identification.

The only evidence found at the point of origin of a disastrous incendiary fire in 1933 was a broken bottle. On one of the fragments was found a fairly distinct fingerprint, which was photographed and preserved for future reference. The bottle, being of a peculiar type commonly used in

laboratories, was traced and identified as having come from a certain high school laboratory. Check of the stock of phosphorus on hand at the close of the school term disclosed a small amount missing.

Further investigation developed the fact that two young men, who often assisted a relative with the janitor work at the school, had access to the laboratory unobserved by the janitor. It was also developed that these boys were ardent deer hunters and usually hunted in the vicinity where the fire occurred; that they were seen going in and coming out of the area on the morning of the day of the fire; and that they had often complained of the brush making it difficult to hunt. They denied any connection with the setting of the fire, and refused to give their fingerprints for comparison with the print found on the bottle. Later, however, the prints of one of the boys were obtained, which disclosed that his right thumb had made the print on the bottle. Examination revealed 16 points of comparison or similar characteristics. The boys stood trial and were convicted by a single fingerprint, supported by other material circumstantial evidence.

Signed Statements

Signed statements by suspects and witnesses have proved to be invaluable in the investigation of fire cases. Occasionally a suspect is found who will refuse to sign a statement, but in most cases proper approach on the part of the investigator will bring results.

If a suspect is approached in a friendly manner and told that he is under suspicion, he will usually offer an alibi for his whereabouts at the time the fire started. If he is encouraged to talk and the investigator listens long enough, injecting a pertinent or adroit question now and then to keep him on the track, he will usually end up with a fairly good explanation. It is then indicated to him that his story sounds good, and he is informed that you want to get it straight by starting to write it down, taking him back over the story step by step with an occasional "that's correct, isn't it?" to which he will usually assent, and be impressed with the gullibility of the investigator.

When the statement is completed, the subject is told: "Now I want to read this over to you to be sure it is correct; if anything appears that you object to, we will change it." His signature to the statement is in the mind of the investigator all the time.

When the statement has been read to the suspect, he will be asked: "Now you have told me the truth, haven't you?" to which he will usually say "yes." Then the following is added to the statement: "I have read the foregoing statement and declare it to be true." The written statement is

then handed to him and he is asked to identify it by his signature. He will sign it without hesitancy in the belief that he has put across the idea that he is truthful and that he has explained away any suspicions that might have existed. His story is now available for check by the investigator, and in all probability the major part of it may be disproved. However, it is his story; he has declared it to be the truth, and he will stick to it in the belief that he has put it over.

When the case comes to trial, the suspect probably will have forgotten much of the detail set forth in the statement, and as a consequence he becomes cautious and confused. This will have a tendency to impress the jury with the fact that he is evasive and untruthful. Yet he cannot successfully deny the statement, for the reason that his signature appears thereon.

Fire investigations in the forests, under conditions where seldom an eyewitness to a violation is obtainable, are among the most difficult of all types of criminal investigations. Successful handling, therefore, requires experience, tact, and perseverance on the part of the investigator. It is not enough that a man must have had police experience. He must, first of all, be a woodsman familiar with woods and range conditions to the extent he can detect and interpret evidence on the ground. He must know the rules of evidence in order that he may not spend valuable time in an effort to develop some line of evidence that would not be admissible after he obtained it. He must be familiar with, or at least have a working knowledge of, the technical sciences commonly used in investigational work of a criminal nature, *i. e.*, photography, ballistics, fingerprints, handwriting, chemical analysis, etc. It is not necessary that he be capable of personally using them to reach a conclusion, but he must have a fair conception of their possibilities and know how to avail himself of those possibilities during the course of the initial investigation.

Region 5 at the present time employs nine such men on a temporary basis. They are selected on the basis of prior experience in investigational work and special adaptability. They are placed on forests where special law enforcement problems exist. They work directly under the Forest Supervisor. They attend an annual instruction class under the direction of the senior fire prevention and the Regional law officer, at which meeting written answers are given to one hundred or more questions on things they should know in connection with proper handling of their work. The answers are then taken up, and the subject matter indicated by each question is discussed. After the discussion is ended, written answers are again given to the same questions. In this way it is possible to determine the

effectiveness of the training course and also to appraise a man's ability to think clearly and to act accordingly.

This year's meeting indicated an average improvement of 37 per cent as a result of the discussions and tests. These men are used whenever possible as instructors in law enforcement classes at the spring guard training schools.

It is likewise intended that they shall be of special assistance to rangers and members of the protection force in developing their knowledge of the handling of law enforcement work. It is thoroughly understood that the employment of these men on a forest does not in any way relieve the staff members of their responsibility in the proper handling of their law enforcement work. They are intended as an auxiliary to the regular forces to assist with difficult cases. They are primarily prevention officers, and must also be capable of effectively delivering short prevention talks to schools, service clubs, camp-fire groups, etc., and developing and applying prevention measures of various kinds as the need is recognized.

Aside from the exceptions noted, the technique used in fire investigation is much the same as in other lines of similar endeavor, but practice, perseverance, and versatility in application of such technique are essential to proper progress.

In dealing with the fire prevention situation where every variety of circumstance and condition is encountered, the value of each man's service is largely conditioned by the extent and character of his knowledge of people and conditions in locations where specific fire problems exist.

The experiences gained and the results obtained in law enforcement indicate that we are making definite headway in meeting incendiary conditions. However, there are many other kinds of man-caused fires, and we must not be lulled into any sense of security on the false belief that the job is completed. On the contrary, fire-prevention efforts must be maintained to reduce to a minimum all man-caused fires.

Fire prevention is a large and continuing job and most important. It is necessary to develop and perfect the methods and technique by which prevention is successfully attained, keeping always in mind that this problem will increase with development and use of the forests.

SOUTHERN FIRE-BREAK PLOW

LOUISIANA DIVISION OF FORESTRY

The Hester fire-line plow has been widely and effectively used by Southern forest protective organizations for fire-break construction. This disc-type plow is manufactured in 4 models, including a 2-disc maintenance plow, a 3-disc utility plow, and a 5-disc plow in 2 styles. All models are designed for pulling behind crawler type tractors, and have adjustable wheels which govern the depth of the cut and on which the plow may be transported from one location to another without plowing. The purchase price ranges from $350 to $500.

Fire-line plowing with 40 H.P. tractor and 3-disc Hester plow in southeastern Louisiana

When in operation, the plows cast soil beyond the shoulders on either side of the actual cut, thereby increasing the effective width of the line plowed. Shipping weights and width of cut are as follows:

Model	Number of discs	Drawbar pull	Shipping weight	Actual width of plow cut	Effective width of fire line
Standard	5	25 H.P.	2445 lbs.	5–6 ft.	8– 9 ft.
Wide cut	5	35 H.P.	2539 lbs.	6–7 ft.	10–11 ft.
Utility	3	20 H.P.	1115 lbs.	3 ft.	5– 6 ft.
Maintenance	2	20 H.P.	1219 lbs.	6 ft.	

When in use, it is customary for the tractor operator to also operate the plow, which is designed to require no special operator. Usually an extra man or two is necessary to clear obstacles from the path of the tractor.

LOOKOUT MAP MOUNTING

ALABAMA STATE FOREST SERVICE

The following directions apply specifically to the mounting of 30-inch circular tower maps on prestwood (Masonite) base developed by the Alabama State Forest Service. The same methods may be adapted for other types of mounting.

Follow the procedure in order of numbered steps for satisfactory results:

1. Place map prestwood base on level wood surface with smooth side up and "tack" securely with several straight pins along the circumference to prevent moving during following operations.

2. Wash the smooth surface of prestwood base clean and let dry.

3. Brush paste evenly so that there is a smooth, unbroken film over the entire surface of base. *Caution:* Mix paste powder with water to make a *thick filmy paste*. Be sure paste is smooth, contains no lumps, and is thin enough for easy brush application.

4. Dampen underside of map.

5. Place map in position on the map base. *Caution:* Map must be placed so that tower is in *exact* center of map base. Do this by first driving vertically a pin (without head) in the exact center of the $\frac{7}{16}$-inch hole of the map base. Of course, the pin must be driven into the surface on which the base rests. Then the map is placed in position, with the pin protruding through the map at the *exact* location of the tower.

6. Roll map smooth with roller, expelling excess paste from under map. Use a moist cloth to keep surface of map soft and pliable during rolling operation. *Caution:* It takes considerable time to complete this operation. Excess paste must be expelled gradually at the edge of map. The excess paste helps to improve the bond between map and base because it works up into the paper.

7. Apply damp cloth frequently to surface of map throughout the entire rolling operation. *Caution:* DO NOT LET MAP DRY. Otherwise map cannot be rolled smooth and free of wrinkles.

8. Remove with a clean wet cloth any paste which may have gotten on surface of map following the rolling operation. Let map dry.

10. After Azimuth circle and map are thoroughly dry remove pins and give "backside" (or rough side) of prestwood base a coat of shellac in a strip 3 inches wide along the outer edge. When shellac dries it provides surface for tape to adhere to.

11. Binding or taping operation provides for binding the edge of the Azimuth circle and map securely to the map base. Cut "Scotch Masking Tape" in pieces 3 inches long. Moisten a piece and place one *end* in position on the margin (¼ inch) provided on the Azimuth circle. Lap other end of tape over the edge of map base and press firmly in place on the under side. Repeat this operation with each succeeding piece of tape, overlapping a little until the entire edge of map is protected by tape.

12. Complete all detail to be shown on map, including water coloring of ownerships.

13. Apply two coats white shellac all over mounted map—top and bottom.

14. Apply two coats clear spar varnish all over top and bottom. *Note*—Spraying is more desirable than brushing on shellac and varnish. *Caution:* If using brush, be careful not to "bleed" colors and ink used in giving additional detail.

15. Mounted map is placed in oriented position on 30-inch circular tower map table and held in place by copper band completely encircling the map and tacked in place at 3-inch intervals. Tacks are driven through copper band into table top.

16. Each map is provided with a sack-like waterproof canvas cover large enough to cover table and telephones, and with grommets and draw-string.

17. Cover is kept in place at *all* times when tower is not manned.

Materials for Mounting Tower Map

1. *Base*—Material—Prestwood $\frac{3}{16}$ inch thick. Circular in shape, with $\frac{7}{16}$-inch hole in center for alidade socket bolt.

2. *Azimuth Circle*—Made of paper 30 inches in diameter and 1½ inches wide, including ¼-inch margin along outside circumference to permit taping.

9. Mount Azimuth circle in position, using the same procedure outlined for the map.

3. *Map*[1]—Circular, 30 inches in diameter, scale ½ inch to 1 mile. Tower located at center of map. Principal land ownerships water colored. Place legend on unused portion of map, if advisable. All other towers should be shown on map and provided with suitable azimuth circle. (5 inches to 7 inches diameter.)

4. *Paste*[2]—Ordinary paper hangers' paste, purchased in dry powder form at 15 or 20c per pound.

5. *Paint Brushes*—(a) Small, flat brush for applying paste; (b) Camel hair brushes for water coloring; (c) Small, flat brushes for applying shellac and varnish.

6. *Cloth*—Supply of cotton cloth. Include one or two pieces large enough to completely cover map.

7. *Roller*—Small hand roller (1 inch wide and 1⅜ inches in diameter), Ridgeley No. 12 or similar.

8. *Pins*—Supply of ordinary straight pins.

9. *Tape*—Roll "Scotch Masking Tape" ¾ inch wide.

10. *Shellac*—Quantity white, clear shellac.

11. *Varnish*—Quantity clear spar varnish.

12. *Spray Gun*—If available, spraying is best method to apply shellac and varnish.

This completes the mounting procedure.

Additional Equipment Used in Towers

13. *Map Table*—Circular, 30 inches in diameter—2 inches thick of wood, carefully sawed.

14. *Copper Band*—A copper band 30 inches in diameter, about 2½ inches wide, punched along center at 3-inch intervals for tacks, is used to hold map in place on table. Band slips over map and table and rests in place on map because of a round "bead." This bead also is a great protection for edge of map when in use in tower.

15. *Canvas Cover*—A large, round, flat-bottomed, waterproof, sack-like canvas cover, equipped with grommets and drawstring and large enough to cover entire map table and telephones.

[1]Texas uses black line prints because there is a minimum of distortion. Blue line prints last longer but distortion is too great.

[2]Arkansas prefers Frisket cement in order to minimize stretching or distortion. Texas prefers Sanford's Flo-Gum Paste (a water paste).

PRESSURE TABLES FOR RUBBER-LINED HOSE

By Fred W. Funke

Fire Equipment Specialist, Region 5

There has been a definite need for a simple method of determining what losses can be expected in 1-inch and 1½-inch rubber-lined hose. Curves and tables which have been available in the past are of little use to the field operator. His concern is with a specific problem, and he does not have curves to determine what is taking place on a given pumping job.

The following tables have been prepared to provide something which will answer the questions raised in pumping problems. The data are based on curves prepared by Roy Bainer, Assistant Professor of Agricultural Engineering of the College of Agriculture, University of California, at Davis, California. The curves were developed during an experiment with small size fire hose in 1930.

With the curves as a base, various weighing factors have been applied so that the data, while having been developed by interpolation of a series of control points, represent a calculation of sufficient accuracy for all practical purposes. It was an interesting thing to check the accuracy of the data against actual performance. The tables were developed primarily for use with tank truck pumpers, where various losses become involved due to piping systems. They are equally applicable, however, to portable field units.

It is hardly practicable to effectively distribute more than 15 G.P.M. on a moving fire front, due to inability of the average crew to shift a loaded hose line. In the interest of water conservation where tank truck equipment is used it is necessary for the pump operator to know what pressure and gallonage is required at the nozzle under any given set of conditions. Knowing the factors, it becomes a simple matter to determine what the pump pressure should be to provide a given amount of water at a given pressure at the nozzle.

A separate table is provided for the nozzle tips in general use from one-eighth to one-half inch. The use of the tables may be illustrated as follows (one-eighth-inch nozzle chart): Left-hand bracket indicates on the first line that if 3.1 G.P.M. is desired at the nozzle at a pressure of 50 pounds per square inch through 500 feet of 1-inch hose the pump pressure needed is 53 pounds per square inch. This holds only for a level ground condition.

If the water is pumped to an elevation, assume 130 feet, there is indi-

cated in the lower block under "Pressure in Pounds Per Square Inch For Different Heads of Water," in the fifth column from the left under 30 and opposite 100, a factor of 56.3 pounds. This must be added to the loss of 53 pounds, giving a total of 109.3 pounds per square inch at the pump to deliver 3.1 gallons of water at 50 pounds pressure through 500 feet of 1-inch rubber-lined hose to an elevation of 130 feet.

Once the operator learns that the upper table represents friction loss in the hose and the lower table loss due to the height the water must be lifted, little trouble will be experienced.

It will be noted from the tables that intermediate points may be interpolated. Also, it is possible to determine in advance the limitations imposed by a particular pumping job. As an example: It can be determined from the ¼-inch nozzle chart that 22 G.P.M. could not be pumped through 3,000 feet of 1-inch hose and lifted 800 feet above the pump without developing a pressure of 1,041 pounds at the pump. Obviously such a task would be ruinous to the hose.

1/8" NOZZLE

1. Select desired nozzle pressure or gallons per minute and find the corresponding pump pressure from the following table.

DESIRED Nozz Press	or GPM	PRESSURES AT PUMP FOR THE FOLLOWING HOSE LENGTHS — Length of 1" hose line 500	1000	1500	2000	2500	3000	Length of 1 1/2" hose line 500	1000	1500	2000	2500	3000	DESIRED Nozz Press	or GPM
50	3.1	53	55	58	60	63	65	51	51	52	52	52	53	50	3.1
60	3.4	64	66	69	72	75	78	61	61	62	63	63	64	60	3.4
70	3.7	74	77	81	84	98	91	71	72	72	73	74	74	70	3.7
80	3.9	85	88	92	96	100	104	81	82	82	83	84	85	80	3.9
90	4.2	95	100	104	108	113	117	91	92	93	94	95	96	90	4.2
100	4.4	106	111	115	120	125	130	101	102	103	104	105	106	100	4.4
110	4.6	116	122	127	132	138	143	111	112	113	114	116	117	110	4.6
120	4.8	127	133	139	144	150	156	121	123	124	125	126	127	120	4.8

2. Add the estimated lift converted to pounds per square inch from the following table and you have the gauge pressure required at the pump. (Subtract when pump is above the nozzle.)

PRESSURE IN POUNDS PER SQUARE INCH FOR DIFFERENT HEADS OF WATER

Head feet	0	10	20	30	40	50	60	70	80	90
0	0	4.3	8.7	13.0	17.3	21.6	26.0	30.3	34.6	39.0
100	43.3	47.6	52.0	56.3	60.6	64.9	69.3	73.6	77.9	82.3
200	86.6	90.9	95.3	99.6	104	108	113	117	121	126
300	130	134	139	143	147	152	156	160	165	169
400	173	178	182	186	191	195	199	204	208	212
500	217	221	225	230	234	238	242	247	251	256
600	260	264	269	273	277	231	286	290	294	299
700	303	307	312	316	320	325	329	333	338	342
800	346	351	355	359	364	368	372	377	381	385
900	390	394	398	403	407	411	416	420	424	429

3/16" NOZZLE

1. Select desired nozzle pressure or gallons per minute and find the corresponding pump pressure from the following table.

DESIRED Nozz Press	or GPM	PRESSURES AT PUMP FOR THE FOLLOWING HOSE LENGTHS — Length of 1" hose line 500	1000	1500	2000	2500	3000	Length of 1 1/2" hose line 500	1000	1500	2000	2500	3000	DESIRED Nozz Press	or GPM
50	7.0	61	71	80	90	99	108	53	55	57	59	61	64	50	7.0
60	7.6	73	84	94	105	116	127	63	66	68	70	73	75	60	7.6
70	8.2	85	97	109	121	133	145	74	76	79	82	84	87	70	8.2
80	8.8	96	110	124	138	151	165	84	87	90	93	96	98	80	8.8
90	9.3	108	124	139	154	170	185	94	97	101	103	106	109	90	9.3
100	9.9	121	138	155	172	189	206	105	108	110	115	118	121	100	9.9
110	10.3	132	151	170	188	207	225	115	118	122	125	128	132	110	10.3
120	10.8	145	165	185	206	226	247	125	129	132	136	139	143	120	10.8
130	11.3	157	179	202	224	246	269	135	139	143	147	150	154	130	11.3
140	11.7	169	193	217	241	265	289	145	149	153	157	161	165	140	11.7
150	12.1	181	206	232	258	283	309	155	159	163	167	171	175	150	12.1
160	12.5	193	220	248	275	302	330	165	170	174	178	182	186	160	12.5
170	12.9	205	234	263	292	322	351	176	180	184	188	192	197	170	12.9
180	13.2	217	247	278	308	339	369	186	190	195	199	203	207	180	13.2

2. Add lift in pounds per square inch from the following table and you have the gauge pressure required at the pump. (Subtract when pump is above nozzle.)

PRESSURE IN POUNDS PER SQUARE INCH FOR DIFFERENT HEADS OF WATER

Head Ft.	0	10	20	30	40	50	60	70	80	90
0	0	4.3	8.7	13.0	17.3	21.6	26.0	30.3	34.6	39.0
100	43.3	47.6	52.0	56.3	60.6	64.9	69.3	73.6	77.9	82.3
200	86.6	90.9	95.3	99.6	104	108	113	117	121	126
300	130	134	139	143	147	152	156	160	165	169
400	173	178	182	186	191	195	199	204	208	212
500	217	221	225	230	234	238	242	247	251	256
600	260	264	269	273	277	281	286	290	294	299
700	303	307	312	316	320	325	329	333	338	342
800	346	351	355	359	364	368	372	377	381	385
900	390	394	398	403	407	411	416	420	424	429

1/4 " NOZZLE

1. Select the desired nozzle pressure or gallons per minute and find the corresponding pump pressures from the following table.

DESIRED Nozz Press	DESIRED or GPM	PRESSURES AT THE PUMP FOR THE FOLLOWING HOSE LENGTHS — Length of 1" hose line 500	1000	1500	2000	2500	3000	Length of 1 1/2" hose line 500	1000	1500	2000	2500	3000	DESIRED Nozz Press	DESIRED or GPM
50	12.4	82	109	136	163	190	217	56	60	64	68	72	76	12.4	50
60	13.6	99	131	164	196	228	261	66	71	75	79	84	88	13.6	60
70	14.8	116	154	193	231	269	308	77	82	86	91	96	101	14.8	70
80	15.7	132	175	218	261	304	347	87	92	97	103	108	114	15.7	80
90	16.6	148	196	244	293	341	389	98	104	109	115	121	126	16.6	90
100	17.6	165	219	273	328	382	436	109	115	122	128	134	141	17.6	100
110	18.4	181	240	300	359	418	478	120	127	134	141	147	155	18.4	110
120	19.3	198	264	329	394	459	524	131	138	146	154	161	169	19.3	120
130	20.0	214	284	354	424	494	564	142	150	158	166	174	183	20.0	130
140	20.8	231	307	382	458	434	609	152	161	170	179	188	197	20.8	140
150	21.5	247	328	409	490	571	652	163	173	182	192	201	211	21.5	150
160	22.2	264	350	436	522	608	695	174	184	194	204	215	225	22.2	160
170	22.8	279	370	461	552	643	734	185	196	206	217	228	239	22.8	170
180	23.6	297	395	493	590	687	784	196	207	219	230	242	253	23.6	180

2 Add the estimated lift in feet converted to pounds per square inch from the following table and you have the gauge pressure required at the pump. (Subtract when the pump is above the nozzle.)

PRESSURE IN POUNDS PER SQUARE INCH FOR DIFFERENT HEADS OF WATER

Head feet	0	10	20	30	40	50	60	70	80	90
0	0	4.3	8.7	13.0	17.3	21.6	26.0	30.3	34.6	39.0
100	43.3	47.6	52.0	56.3	60.6	64.9	69.3	73.6	77.9	82.3
200	86.6	90.9	95.3	99.6	104	108	113	117	121	126
300	130	134	139	143	147	152	156	160	165	169
400	173	178	182	186	191	195	199	204	208	212
500	217	221	225	230	234	238	242	247	251	256
600	260	264	269	273	277	281	286	290	294	299
700	303	307	312	316	320	325	329	333	338	342
800	346	351	355	359	364	368	372	377	381	385
900	390	394	398	403	407	411	416	420	424	429

5/16" NOZZLE

1. Select the desired nozzle pressure or gallons per minute and find the corresponding pump pressure from the following table.

DESIRED Nozz Press	DESIRED or GPM	PRESSURES AT PUMP FOR THE FOLLOWING HOSE LENGTHS — Length of 1" hose line 500	1000	1500	2000	2500	3000	Length of 1 1/2" hose line 500	1000	1500	2000	2500	3000	DESIRED Nozz Press	DESIRED or GPM
50	19.4	129	195	261	327	393	459	61	69	76	84	92	99	50	19.4
60	21.3	155	234	314	393	472	551	73	82	92	101	110	120	60	21.3
70	23.0	181	274	366	459	551	644	85	96	107	118	129	139	70	23.0
80	24.5	206	311	416	521	626	731	97	110	122	134	146	159	80	24.5
90	26.0	232	350	469	587	705	823	109	123	137	151	165	179	90	26.0
100	27.4	258	389	521	652	784	915	122	137	152	168	183	198	100	27.4
110	28.8	284	429	574	720	865		134	151	168	185	202	219	110	28.8
120	30.1	310	469	627	786	944		146	165	183	202	220	239	120	30.1
130	31.3	336	507	679	850			158	178	198	218	238	259	130	31.3
140	32.6	363	549	735	921			171	192	214	236	258	279	140	32.6
150	33.6	387	585	782	980			182	206	229	252	275	298	150	33.6
160	34.7	413	624	834				195	219	244	269	293	318	160	34.7
170	35.8	439	664	889				207	233	259	286	312	338	170	35.8
180	36.9	466	704	942				219	247	275	303	331	359	180	36.9

2. Add the estimated lift in feet converted to pounds per square inch from the following table and you have the gauge pressure required at the pump. (Subtract when the pump is above the nozzle.)

PRESSURE IN POUNDS PER SQUARE INCH FOR DIFFERENT HEADS OF WATER

Head feet	0	10	20	30	40	50	60	70	80	90
0	0	4.3	8.7	13.0	17.3	21.6	26.0	30.3	34.6	39.0
100	43.3	47.6	52.0	56.3	60.6	64.9	69.3	73.6	77.9	82.3
200	86.6	90.9	95.3	99.6	104	108	113	117	121	126
300	130	134	139	143	147	152	156	160	165	169
400	173	178	182	186	191	195	199	204	208	212
500	217	221	225	230	234	238	242	247	251	256
600	260	264	269	273	277	281	286	290	294	299
700	303	307	312	316	320	325	329	333	338	342
800	346	351	355	359	364	368	372	377	381	385
900	390	394	398	403	407	411	416	420	424	429

3/8" NOZZLE

1. Select the desired nozzle pressure or gallons per minute and find the corresponding pump pressures from the following table.

DESIRED Noss Press	or GPM	PRESSURES AT THE PUMP FOR THE FOLLOWING HOSE LENGTHS: Length of 1" Hose Line 500	1000	1500	2000	2500	3000	Length of 1 1/2" hose line 500	1000	1500	2000	2500	3000	DESIRED Noss Press	or GPM
50	27.9	213	350	486	622	758	895	72	88	104	120	136	152	50	27.9
60	30.6	257	421	584	748	912		87	106	125	144	164	183	60	30.6
70	33.1	300	492	684	875			101	124	146	169	191	214	70	33.1
80	35.3	342	560	778	996			116	141	167	192	218	244	80	35.3
90	37.5	385	631	878				130	159	188	217	246	275	90	37.5
100	39.5	428	701	974				145	177	209	241	273	305	100	39.5
110	41.4	470	770	1070				159	194	229	265	300	335	110	41.4
120	43.3	514	842					174	212	251	289	328	366	120	43.3
130	45.1	557	913					188	230	272	313	355	397	130	45.1
140	46.8	600	983					203	248	293	338	382	427	140	46.8
150	48.4	642	1052					217	265	313	361	409	457	150	48.4
160	50.0	685	1123					232	283	334	386	437	488	160	50.0
170	51.5	727	1191					246	300	355	409	464	518	170	51.5
180	53.0	770	1261					261	318	376	433	491	549	180	53.0
190	54.5	814	1334					275	336	397	458	519	580	190	54.5
200	55.9	856	1403					290	354	418	482	546	610	200	55.9
210	57.3	899						304	372	439	506	573	641	210	57.3
220	58.6	941						319	389	459	530	600	671	220	58.6
230	60.0	986						333	407	481	555	629	702	230	60.0

2. Add the estimated lift in feet converted to pounds per square inch from the following table and you have the gauge pressure required at the pump. (Subtract when the pump is above the nozzle.)

PRESSURE IN POUNDS PER SQUARE INCH FOR DIFFERENT HEADS OF WATER

Head Feet	0	10	20	30	40	50	60	70	80	90
0	0	4.3	8.7	13.0	17.3	21.6	26.0	30.3	34.6	39.0
100	43.3	47.6	52.0	56.3	60.6	64.9	69.3	73.6	77.9	82.3
200	86.6	90.9	95.3	99.6	104	108	113	117	121	126
300	130	134	139	143	147	152	156	160	165	169
400	173	178	182	186	191	195	199	204	208	212
500	217	221	225	230	234	238	242	247	251	256
600	260	264	269	273	277	281	286	290	294	299
700	303	307	312	316	320	325	329	333	338	342
800	346	351	355	359	364	368	372	377	381	385
900	390	394	398	403	407	411	416	420	424	429

1/2" NOZZLE

1. Select the desired nozzle pressure or gallons per minute and find the corresponding pump pressure from the following table.

DESIRED Noss Press	or GPM	PRESSURES AT THE PUMP FOR THE FOLLOWING HOSE LENGTHS: Length of 1" hose line 500	1000	1500	2000	2500	3000	Length of 1½" hose line 500	1000	1500	2000	2500	3000	DESIRED Noss Press	or GPM
50	49.5	567	997					121	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	50	49.6
60	54.3	679	1195					145	205	266	326	386	447	60	54.3
70	58.9	799	1406					170	241	312	383	454	525	70	58.9
80	62.8	908	1499					193	274	355	436	517	598	80	62.8
90	66.6	1021						217	308	399	490	581	672	90	66.6
100	70.2	1135						242	343	444	545	646	746	100	70.2
110	73.7							266	377	489	600	711	822	110	73.7
120	76.9							290	411	532	653	774	895	120	76.9
130	80.1							314	446	577	709	840	972	130	80.1
140	83.1							338	480	621	763	904	1046	140	83.1
150	86.0							362	514	666	817	969	1120	150	86.0
160	88.9							387	549	711	873	1035		160	88.9
170	91.6							411	583	755	927	1099		170	91.6
180	94.3							435	618	800	982	1164		180	94.3
190	96.8							459	651	843	1035			190	96.9
200	99.3							483	685	887	1089			200	99.3
210	101.5							507	720	932	1145			210	101.8
220	104.2							532	754	977	1199			220	104.2
230	106.6							557	790	1021				230	106.6
240	108.8							580	822	1065				240	108.8
250	111.1							604	857	1110				250	111.1

2. Add the estimated lift in feet converted to pounds per square inch from the following table and you have the gauge pressure required at the pump. (Subtract when the pump is above the nozzle.)

PRESSURE IN POUNDS PER SQUARE INCH FOR DIFFERENT HEADS OF WATER

Head Feet	0	10	20	30	40	50	60	70	80	90
0	0	4.3	8.7	13.0	17.3	21.6	26.0	30.3	34.6	39.0
100	43.3	47.6	52.0	56.3	60.6	64.9	69.3	73.6	77.9	82.3
200	86.6	90.9	95.3	99.6	104	108	113	117	121	126
300	130	134	139	143	147	152	156	160	165	169
400	173	178	182	186	191	195	199	204	208	212
500	217	221	225	230	234	238	242	247	251	256
600	260	264	269	273	277	281	286	290	294	299
700	303	307	312	316	320	325	329	333	338	342
800	346	351	355	359	364	368	372	377	381	385
900	390	394	398	403	407	411	416	420	424	429

A GENERAL PLAN FOR THE USE OF RADIOS ON FIRES

By A. K. Crebbin

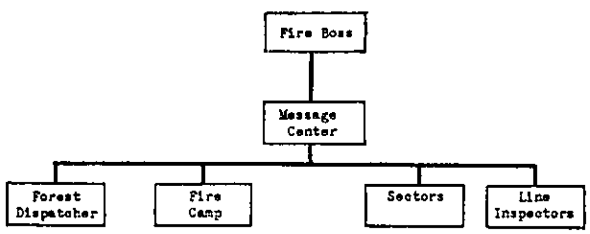
Technical Assistant, Klamath National Forest

The radio has been a great step in advancement of communication on fires. But the improved efficiency of the radio is not the end to improved communication. The radios on a fire will be only as valuable as the increased communication can synchronize and centralize the fire-control functions.

The object of this plan is to converge all radio communication to avoid confusion in lines of communication and to centralize all information and orders pertaining to the fire to further coordination in the suppression functions.

To do an effectual job of fire suppression the fire boss must have communication to the fire-line sectors, line inspectors, scouts, fire camp, and forest dispatcher. And as the fire boss must have mobility for the performance of his duties it is impossible for him to be in constant communication with these points. Therefore the point of convergence of radio communication is set up as a message center, which is the only point of contact authorized for all sets used in the suppression of the fire.

The following diagram shows the communication authority:

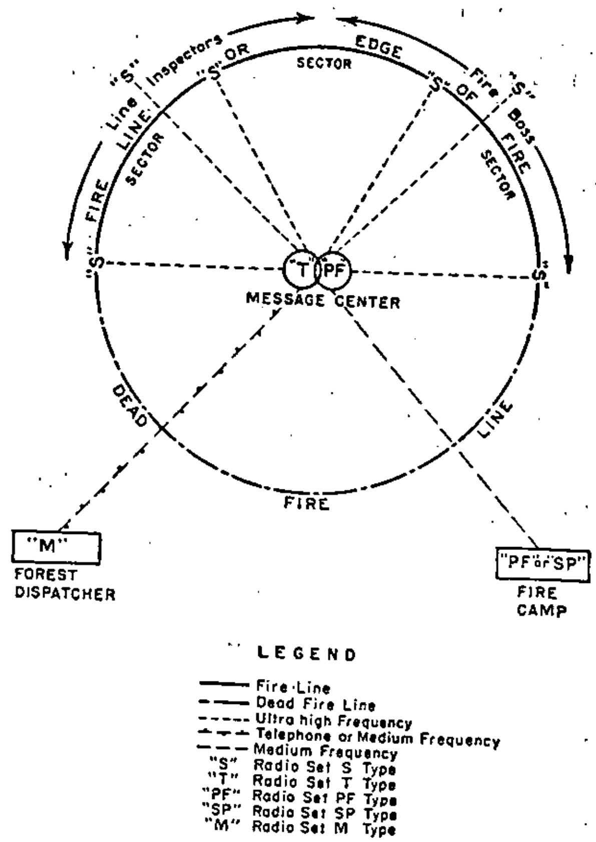


The message center is the nerve center of the fire-control activities. It receives all information on fire-control strategy, fire conditions, fire-control orders, and location and amount of manpower and supplies on the fire line, in the fire camp, and on call at headquarters.

This information is logged and, when necessary, relayed to the proper station. The information is also segregated on forms, maps, etc. (after the general practice on the unit where the fire occurs), to be readily available for the guidance of the fire boss and other officers.

. . The message-center chief is ex-officio fire boss, as he is the mouthpiece and information center for the fire boss.

FIRE RADIO COMMUNICATION PLAN



The illustration represents diagrammatically the lines of communication, frequencies, and sets used for communication between the message center and all of the fire-control stations.

Our communication frequencies are of two types—ultra high and high. The ultra high frequency can be used only between intervisible or nearly intervisible points, while the high frequency is not dependent on intervisibility. Therefore, to obtain maximum efficiency out of both frequencies the message center should be located on a point having the most direct visibility over the entire fire area. It can be located within the fire in a

"cold" area, on a point a considerable distance from the fire or in the fire camp. As the factors considered in locating the fire camp are nearness to fire, water, level ground, communication, and transportation, the fire-camp locations are not generally favorable locations for the message center.

The ultra high frequency is best adapted to the fire-line stations because the "S" sets are more readily portable, simple in operation, and points on all sectors of the fire line can generally be found to establish intervisible communication with the message center. And the high frequency is well adapted to message center—fire camp—dispatcher communication, as the dispatcher is generally equipped with a high-frequency set and the fire camp can be established in a favorable location without regard to intervisible communication with the message center.

It is also the duty of the message center chief to schedule all communication. The high frequency doesn't interfere with the ultra high frequency, and as the stations are few and widely separated a schedule isn't usually required. The following schedule is recommended for the fire line:

Starting on the hour, 3-minute schedule for a definite sector schedule, followed by 7 minutes for emergency calls and contact with fire boss, line inspectors, etc. This allows 6 cycles per hour, or 18 minutes for sector schedule and 42 minutes of open schedule.

The number of sets on the fire line should be governed by the same factors as is the size of a sector (size of job, importance of job, difficulties of travel).

It is recommended that one set with an operator be allotted to each sector.

The fire boss, line inspectors, and others may find it convenient either to contact the message center through the sector stations or to carry and operate individual sets.

The message center personnel should be large enough to operate both sets and to assist the message center chief to log and segregate all information. This system of communication enables the fire boss to supervise all of the fire-control activities and still be in direct contact with the latest developments. He can contact the message center from numerous places on the fire line with his "S" set, any fire-line station or the fire camp, and receive all of the fire information or relay orders to all fire-line stations, the fire camp and the forest dispatcher. He also informs the message center

of all fire-control strategy, which enables the message center to confirm all orders.

The key to success of this plan is the message center chief. He should be a man with the ability to segregate all the information and relay it without delay to the officers concerned, and also control the communication lines without confusion.

I have purposely avoided details, such as the servicing of radio sets, number of sets and batteries to be held in reserve, and where possible the personnel involved, as even within a Region forests have different methods of arriving at the same end.

On visualizing this plan please remember that it is a general plan, and that its principle is offered that it may be expanded or modified to fulfill the needs of fire suppression under various conditions.

OKLAHOMA FIRE LINE PLOW

OKLAHOMA FORESTRY DIVISION

The Oklahoma fire plow was originally developed by State Forester Glen Durrell, when Chief of Fire Protection in the Oklahoma Forest Service, and more recently improved by him while heading up the fire protection work in Arkansas. Both State organizations, therefore, may properly claim credit for the development and improvement of this power plow. Oklahoma is operating two of the plows successfully and Arkansas has one which is giving good results.

This tractor plow has the distinct advantage of portability and maneurverability, which is a most necessary requisite, as it is used for direct control on "going fires." One man operates the complete outfit, and it has the further advantage of being an attachment direct to the tractor. It is dispatched to a fire on a two-ton truck, loading and unloading under its own power.

The plow, middle buster type, is mounted on the end of a free swinging boom in front of a light crawler type, 20 H.P. tractor. The boom, coupled to the rear end of the tractor, extends forward under it and beyond the front end sufficiently to permit attaching the plow. Maneuverability is demonstrated by the fact that the tractor operator can lift the plow clear, which permits him to back up, travel, or avoid obstacles. He can also lower it into position for plowing. This operation is accomplished by means of a cable attaching the forward end of the boom to a lift drum operated by a worm reduction gear motivated by a hand-operated crank lever.

The plow has been operated very satisfactorily in fairly rough country such as is found in southeast Oklahoma and southern Arkansas. Obviously very steep terrain and areas where there is much down timber or bedrock would prevent satisfactory operation. In Oklahoma, the plow is used in shortleaf pine, oak and upland hardwoods types, where considerable loose shale rock is encountered, while in Arkansas it has been used principally in the loblolly-shortleaf pine type.

This plow attachment costs about $300, and must be constructed locally, since no standard specifications have been developed.

INFORMATION FOR CONTRIBUTORS

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

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

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

Illustrations, whether drawings or photographs, should have clear detail and tell a story. Text for illustrations should be typed on strip of paper and pasted on back of illustration. All diagrams should be drawn with the type page proportions in mind, and lettered so as to reduce well. In mailing illustrations, place between cardboards held together with rubber bands. Paper clips should never be used.

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

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