ANALYSIS OF
LOGGING COSTS AND OPERATING METHODS
OF
J. H. CHAMBERS & SON LUMBER CO.

Cottage Grove, Oregon

(June 1936 to March 1937)

by

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ILLUSTRATIONS

GENERAL

The Object

The object of this report is to bring together in systematic form the information and material dealing with up to date Douglas Fir logging methods and costs that I gathered while working for the J.H. Chambers Lumber Co. in Cottage Grove, Oregon.

I. The Area

The area being logged is twenty miles southwest of Cottage Grove, bordering the Siuslaw National Forest. At present the company owns about ten sections of timber and has access to enough timber to allow an indefinite period of logging.

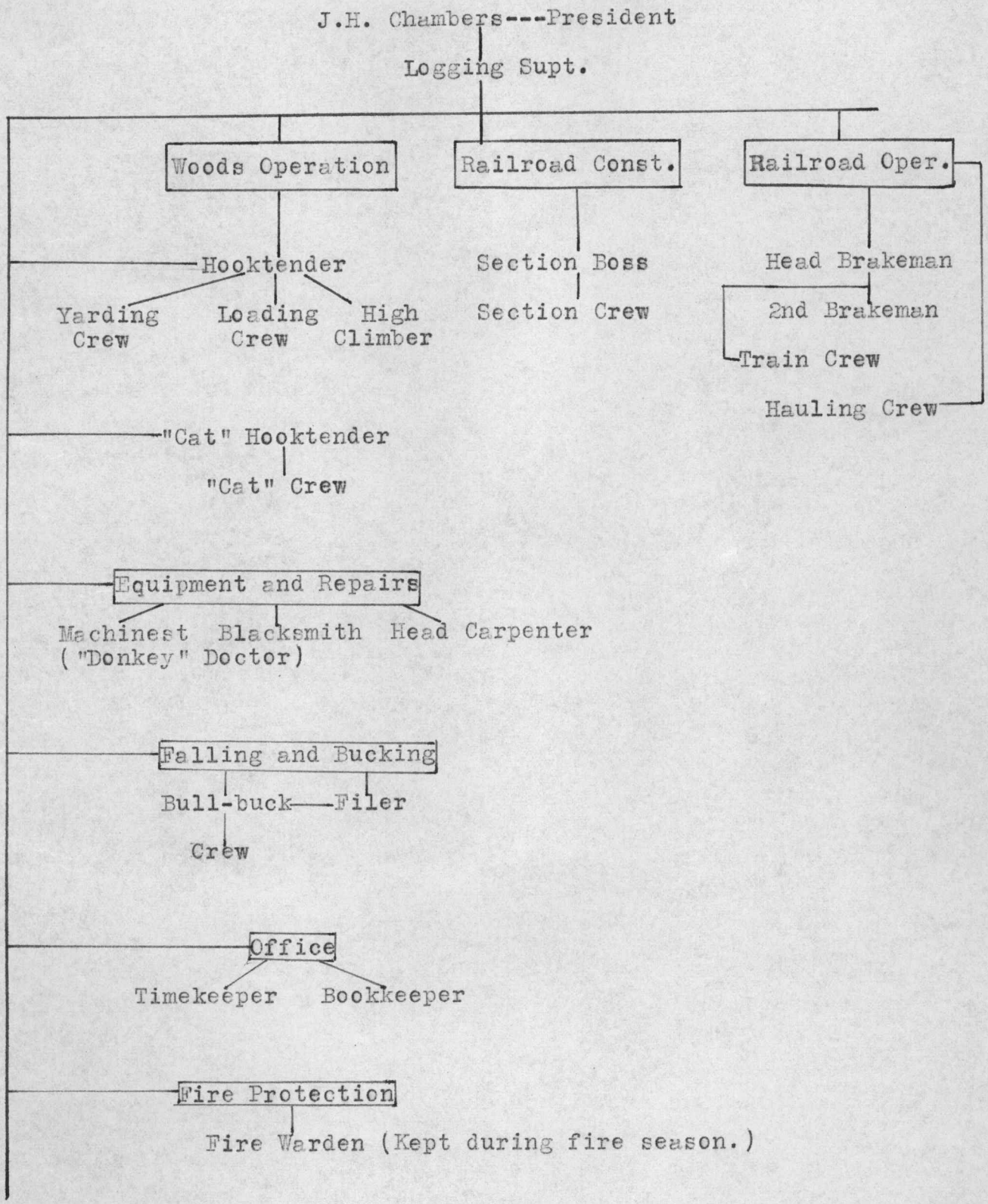
The species of timber being logged are mainly Douglas Fir, Western Hemlock, some Noble Fir, and a small amount of Incense Cedar.

II. Size of Operation

The daily output of this operation varies from 90M to 110M feet, depending entirely upon how accessable the logs are.

At present the operation is made up of two sides, one side logging with "donkeys", and the other side logging with two Cletrac 80's and swinging with a "donkey". The output of each side averages about 50M feet per eight hour day.

III. Organization of the Personnel



IV. Labor

A. Length of employment

There is little labor turnover because (1) this company logs the entire year, and loggers are able to work the year around, not just seasonally, and (2) the loggers live in town and are transported to their work daily.

B. Methods of employment and wage payment

This company runs a non-union camp, and the men are hired either by the logging supt. or by the general manager.

The men are paid by the hour, with the exception of the logging supt., hooktender, and time keeper who are paid by the month. There is no contract work done.

The men are paid twice a month for their convenience. Wages paid in this section are somewhat lower than those paid in other sections of Oregon and Washington. Following is a list of wage rates being paid at present.

No. of Men	Type of Work	Rate on 8 hr. Basis	
1	Bull-buck	$6.50	
1	Filer	7.00	
4	Head Fallers	4.80	19.20
4	Second Fallers	4.40	17.60
4	Buckers	4.50	18.00
1	Rigging Slinger	5.00	
8	Choker Setters	4.40	35.20
2	Chasers	4.50	9.00

No. of Men	Type of Work	Rate on 8 hr. Basis	
1	Sniper	$3.60	
2	Whistle Punks	3.60	7.20
4	"Donkey" Punchers	6.00	24.00
4	Wood Bucks	3.80	15.20
2	Head Loaders	5.00	10.00
2	2nd Loaders	4.60	9.20
1	Pump Man	4.20	
1	Carpenter	5.00	
1	Mechanic	5.00	
2	Locomotive Engrs.	6.00	12.00
2	Locomotive Firemen	5.00	10.00
1	Brakeman	4.90	
1	2nd Brakeman	4.50	
5	Rock Crushermen	3.60	18.00
2	Caterpillar Drivers	7.00	14.00
1	"Cat" Hooktender	7.00	
1	Section Foreman	5.50	
10	Section Crew Men	3.60	36.00
1	Supt.	Approx. $250.00 per mo.	10.00
1	Timekeeper	" 125.00 per mo.	5.00
1	Hooktender	" 150.00 per mo.	6.00
71			$333.80

Av. wage = $4.70

V. Stumpage Price

At the present time this company is paying from $1.25 to $1.50 per M for stumpage. Recently the company purchased a section of government timber, paying $1.50 per M, on which logging will begin in May.

VI. Investment

Considering the size of the operation, I would say that the investment is extremely large, including railroad and equipment, being about $300,000.00.

$300,000 in 20 miles of R.R. without any equipment - see page 26

VII. Steps in the Operation

The work in every department is specialized from the wood buck to the hooktender.

The logs are not scaled and graded until they reach the pond. The Columbia River scale log ~~rule~~ is used.

I am going to cover the actual steps of the logging operation, giving a cost analysis of each step, in the following order:

Falling and Bucking

Yarding (General)

High-lead Yarding

Tractor Yarding

Swinging

Loading

Inclines

Railroad Transportation

FALLING AND BUCKING

I. Organization of the Crews

The bull-buck selects the trees to be felled and determines the direction of the fall. A crew of two fallers do the falling. The bull-buck then marks the log lengths for the guidance of the buckers who work singly with a crosscut saw, wedges, etc.

Head fallers and the individual buckers are held responsible for the quality of the work.

II. Stump Heights

The practise is to cut the stumps as low as possible, the average height being about two feet.

III. Log Size and Lengths

The logs average from 35" to 42" in diameter.

The average log length is 40', but near the end of the summer logs were being taken out in 80' to 100' lengths. In other words, the buckers just topped the trees. Thus the speed of the buckers was increased, and a greater scale was taken out each day. These long logs were bucked in the pond.

IV. Long Butting

Long butting is practised considerably on defective logs because it costs just as much to mill defective timber, and no profit can be had from it.

V. Breakage

Breakage is reduced to a minimum by this organization. The average percentage of breakage ranges from 2% to 4%. This low percentage is due to the following facts:

1. Falling is done by experienced fallers.
2. Windfalls are bucked ahead of falling.
3. Felling timber across unbucked trees is generally avoided.
4. Increased wedgings are made by fallers if necessary.
5. Large trees are felled first.
6. Fallers are paid on a per hour basis.

VI. Output

A. Fallers: 30,000 to 35,000 feet per day, per set of two. Maximum of 40,000 feet.

B. Buckers: 25,000 to 35,000 feet per day, per man. Usually one bucker to each set of fallers. More or less as conditions demand.

VII. Tools and Equipment

A. Saws: one falling saw to each set of fallers, length--- 8 feet. One bucking saw for each bucker, most common length---7½ feet.

B. Axes: one double bitted axe for each faller, 3½ to 4½ pounds. One swamping axe for each bucker, 4 to 5 pounds.

C. Steel sledges: for driving wedges, 10 pounds for fallers and 8 pounds for buckers.

D. Springboards: two to each set of fallers in other than second growth timber and even ground.

E. Steel wedges: four or five to the faller and to each bucker.

F. Undercutters: necessary in bucking to hold the saw to the log when cutting the underside of the fallen tree.

VIII. Filing

Filing is done by an expert filer. On an average, saws are filed every other day.

IX. Costs

Costs for falling and bucking taken over a period of five years averaged 82 cents per M, including labor, equipment, wear and tear on equipment, and filing.

This cost was influenced by the following factors:

1. Efficiency of labor and management.
2. Scale of wages.
3. Weather conditions.
4. Size of timber.
5. Percentage of breakage.
6. Density of stand, and species.
7. Percentage of defect.
8. Length of logs.
9. Amount of windfalls.
10. Topography.
11. Amount of brush.
12. Distance of work from camp.

YARDING (GENERAL)

I. Types of Yarding

A. "Donkey" high-lead yarding.

B. Tractor yarding.

1. Tractor high-lead yarding.

2. Tractor roading.

II. Choice of Method

A. Topography

Yarding direction and its relation to the slope of the ground help determine the type of yarding to be used. On adverse slopes it is impossible to use the tractor. When the general nature of the area is too rough and is considerably chopped up, it is not advisable to use tractors.

When tractor logging is done during the rainy season, the element of mud cuts the efficiency of the tractor in half; therefore, the condition of the soil is to be considered.

The general contour of the ground is considered in yarding. If the logs have to be taken out up hill, the "donkey" is used exclusively. If the ground is rough and has a number of deep gulleys, eventhough the general slope to the landing is down, it is advisable to use the "donkey", but the tractor can be used. If the ground is practically level or sloped down to the landing, the tractor is used exclusively.

B. Yarding distance

Yarding distance influences the choice of method. The maximum economic range for "donkey" yarding is 1100 feet, but usually the distance yarded does not exceed 1000 feet. In the case of tractor yarding, the yarding distance depends upon the number of tractors used.

It is the policy of the logging superintendent of this company not to let the yarding distance exceed 1800 feet if possible.

C. Timber

Size of the timber has some effect in deciding what method is to be used. The amount of timber per acre also has some influence.

D. Cost

The cost of one method in comparison with the cost of the other method might be the final factor to be considered. The following is a comparison of costs taken over a period of one year. These costs cover the yarding operation only.

III. Yarding Costs

This company divides its total logging costs into yarding, loading, and swinging. The following costs do not include taxes, interest, or depreciation.

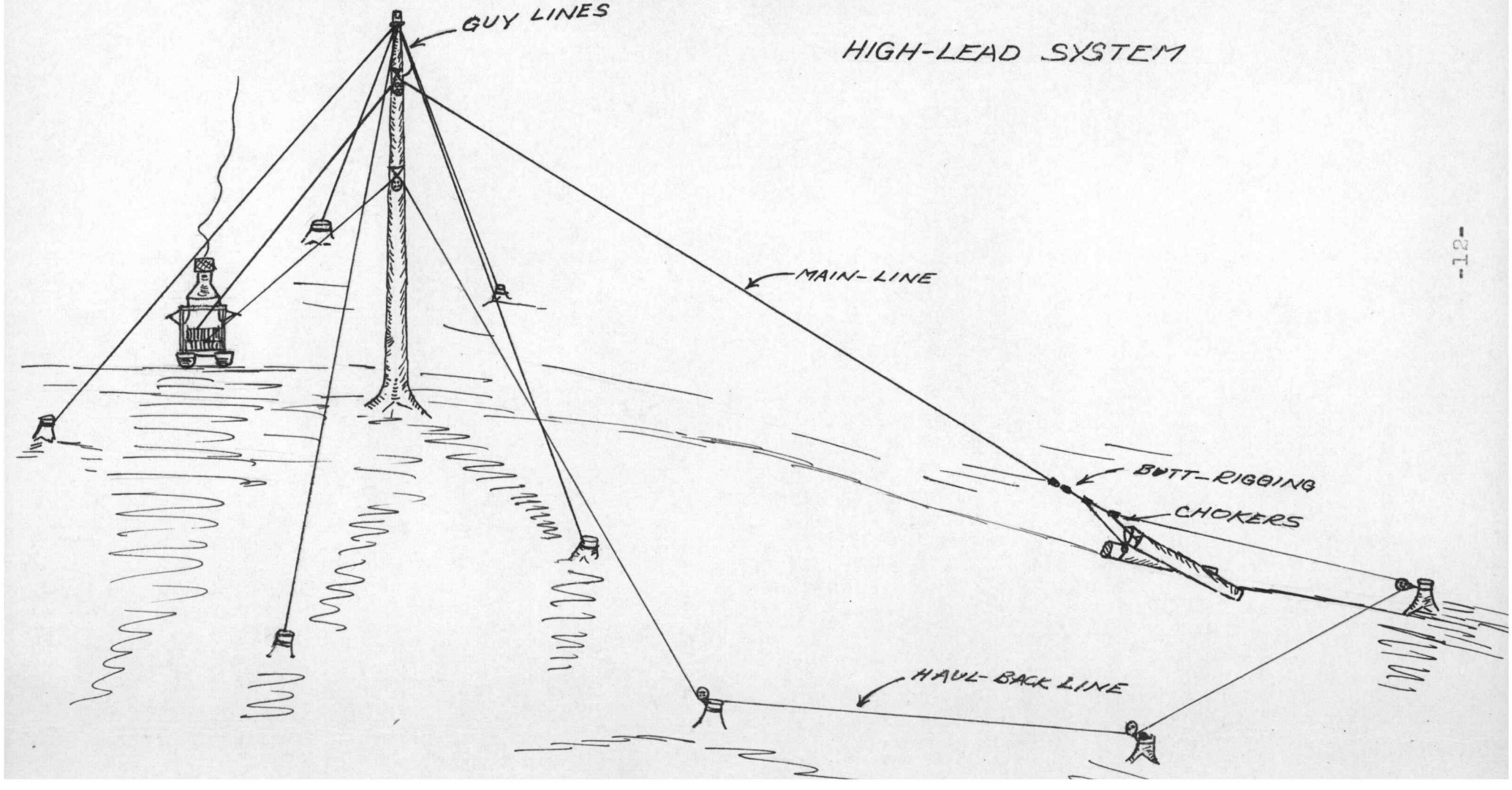
Costs based on 1M board feet.

A. "Donkey" high-lead yarding

Labor					
Engineer	.05				
Fireman	.04				
Wood bucks(2)	.07				
Chasers(2)	.09				
Hooktender	.02½	(.02½	to swing.	.02½	to load.)
Head rigger	.05				
Choker setters(4)	.18				
Whistle punk	.04				
High climber	.02	(.02	"	.02	")
Pumpman	.02	(.01	"	.01	")
Wire rope	.15	(.10	"	.05	")
Oil	.02	(.02	"	.01	")
Wood	.04	(.04	"	.02	")
Water	.03	(.03	"	.01	")
Fire	.01	(.01	"	.01	")
Powder	.01	(.01	")		
Rig-up	.05	(.05	"	.02	")
Maintenance	.30	(.20	"	.10	")
Total	$1.19½				

B. Tractor yarding

Labor	
"Cat" drivers(2)	.12
Choker setters(4)	.16
Hooktender	.06
Wire rope	.07
Supplies,fuel,etc.	.09
Maintenance	.40
Total	.90


GUY LINES
HIGH-LEAD SYSTEM
MAIN-LINE
BUTT-RIGGING
CHOKERS
HAUL-BACK LINE

HIGH-LEAD YARDING

I. Method

A head spar tree is needed. The tree must be from 150 to 200 feet high and guyed rigidly. A high-lead block is hung near the top of the tree. The main line is run from the main line drum to high-lead block to tail block. For safety, the high-lead block is fastened by means of a two inch steel strap or cable. There is also a safety ~~guy~~ strap rigged to shunt the block slowly to the ground along one of the guylines in case the strap should break. (See p. 26)

II. Advantages of the System

A. Gives a lift to the logs and prevents hanging on stumps.

B. Keeps logs from nosing into the ground.

C. Keeps landing free of debris.

D. Does not require a prepared landing.

III. Moving of Engines

A. Time

Time spent in moving the engines is time lost in actual work. It takes from 8 to 16 hours to move an engine from one setting to another, and the speed depends upon whether the engine is moved on flat cars or is dragged on the ground by its own power. It usually takes from 2 to 4 hours to move from one end of the landing to the other.

One method of saving time, of course, is to have an extra engine and to have one set up in the new position in advance. An extra engine also provides the opportunity to look over the idle machinery and to put it in order.

B. Cost

Having to move engines increases the cost of logging very much. The actual cost is not so high when the moving is done by a special crew or by the crew that clears the right of way, but, as this is only a small operation, the moving is done by the loggers themselves.

The average cost of rigging up, including moving the "donkey", is $275.00 to $300.00 for a yarder pole and $400.00 for a landing pole.

IV. Setting the Lines

A. Method

The yarding crew runs out the main line and the return line. The first step is to locate the first yarding road. The roads, or routes, which the logs follow usually start at the railroad and run in a radial direction until they run out of the show on the other side.

The straw line is then run out by hand and fastened to a block at the tail tree at the far end of the yarding road; then it is run about 330 feet or more to the right or left through another block and back to the engine. There the end of the straw line is attached to the haul-back line, and the other end is reeled in on a small drum.

Thus the haul-back is dragged through the blocks and back over the road to the yarder. The straw line is then detached, and the end of the main line is fastened to the trip line by means of a clevis. The engine is then ready for operation.

B. Sizes of lines

1. Main line	1 1/4"	6 strands,	19 wires,	steel core
2. Haul-back	7/8"	"	"	" "
3. Straw line	3/8"	"	"	hemp core
4. Guylines	1½"	"	7 wires,	rope core
5. "Donkey" choker lines	1 1/4"	"	19 wires,	steel core
6. "Cat" main line	1"	"	"	" "
7. " choker line	7/8"	"	"	" "
8. Skyline	2"	"	"	" "

C. Types of blocks

1. Haul-back blocks
2. High-lead blocks
3. Pass line blocks
4. Side blocks

V. Operation

The choker setters set the chokers on the logs. Either the hooktender or head rigger signals the whistle punk to give a signal to pull in the line. The load is dragged to the landing where it is unhooked by the chaser or one of the loaders. The number of logs on a turn depends upon the size of the logs, size of equipment, and the ground conditions. As a rule, one choker is used for each log. Two chokers are attached to one butt rigging.

VI. Organization of the Crew

A. Crew

Hooktender	Chaser
Rigging slinger	Whistle punk
Engineer	Two wood bucks
Fireman	Four choker setters

B. Duties

Division of labor is not always clear. Members of the crew do whatever the occasion demands. The hooktender is in charge of the crew, and its efficiency depends largely upon him. He plans the work, locates the roads, instructs the crew, and assists the rigging slingers.

The head rigging slinger is the hooktender's assistant. Choker men set the chokers on the logs and assist in changing the lines. Also they do general rigging work.

The chaser stands at the landing and signals the engineer when to stop the logs as they come into the landing. His duty is to unhook the chokers. A signal man, or whistle punk, gives the orders of the hooktender or head rigger to the engineer by means of a whistle wire.

VII. Equipment

A. Engines

Size	Size of Boiler	Make	Type
9x10	48"x130" high 175# working pres.	Willamette	Loader
10x11	60"x126" high 200# working pres.	"	"
10x12	66"x120" high 200# working pres.	Tacoma	Yarder
10x12	66"x120" high 200# working pres.	"	"

Size	Size of Boiler	Make	Type
12x13	68"x147" high 200# working pres.	Smith	Yarder
11x13	68"x147" high 200# working pres.	Willamette	"
12x14	68"x147" high 200# working pres.	"	Snubber (used on inclines)

Note: All working pressures are maximum.

B. Other equipment

1. Logging engine sleds are for convenient moving. Cost of construction of 44' sled averages from $450.00 to $500.00, and of 56' to 64' sled, $600.00. They are equipped with heavy chains, rings, and bolts for moving and snubbing. The life of the sled varies with the size of the machine, type of country, and how the sled is built.
2. Fairleaders are needed for both narrow and wide faced drum machines. They are mounted on the front end of the sled. Both the main line and the haul-back line have separate fairleaders.
3. Spark arresters are required by law in Oregon. Approximate cost is $20.00.
4. Extended fire boxes supply extra heat for the boiler.
5. All machines have water tanks made of wood or steel.

C. Blocks

In order to get the greatest efficiency out of the lines, a company must have good logging blocks. There are several outstanding companies that manufacture equipment of this type. In recent years Tyler and Mallory blocks have been the most popular. I sent to the Mallory Co. for illustrations and prices of blocks.

This operation uses all Mallory blocks, probably because it obtained the best price from the Mallory Co. The following blocks are used.

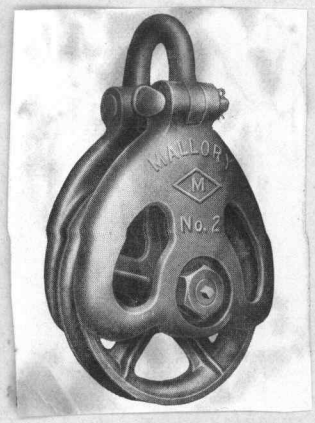
(Note: Sizes given are sizes used by this operation.)

1. High climber's block: size 7"x1½", price $20.00. Used as a general utility block on the spar pole, or as a pass block.
2. High-lead blocks: size 36"x6", price $900.00. Used for high-lead system on spar pole.
3. Moving blocks: size 16"x3" and 20"x3", price $200.00. Used mainly to move engines and as a general utility block.
4. Haul-back blocks: size 14"x2½", price $100.00. Used on the haul-back line and as a general utility block.
5. Loading blocks: size 14"x2" tongline, price $140.00.
   size 14"x2½"loader, price $180.00.
   Used in conjunction with the heel-boom and loading rig.
6. Boom-swing blocks: size 12"x2", price $110.00. Used on the loading rig.
7. Loading jack: size 22"--10"x2", price $145.00. Used in conjunction with the counter balance on the boom-swing.
8. Tree-shoe: size 48"x3", price $175.00. Used on the skyline.
9. Carriage: size 16"x4", price $825.00. Used on skyline for the North Bend system.

10. Fall block: size 18"x2½", price $475.00. Used in conjunction with the North Bend system.

The above prices are from the catalogue, but this company recieves a discount of 20% on 20%, which would cut the price almost in half.

HIGH-LEAD BLOCK



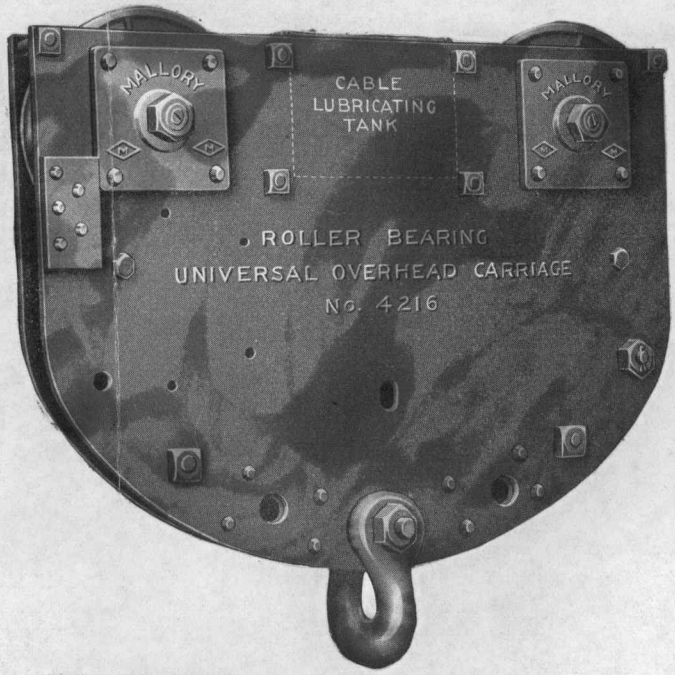
HIGH-CLIMBERS BLOCK

FALL BLOCK

MOVING BLOCK

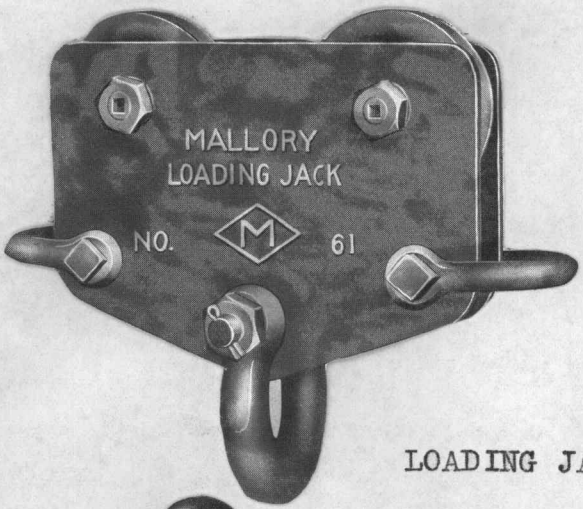
HAUL-BACK BLOCK

BOOM- SWING BLOCK



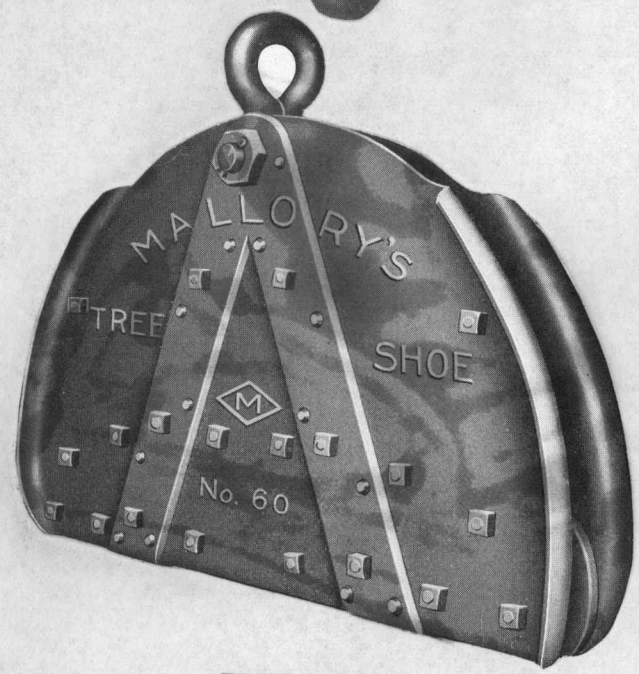
SKYLINE CARRIAGE

LOADING BLOCK



LOADING JACK

LOADING BLOCK



TREE SHOE

TRACTOR YARDING

TRACTOR HIGH-LEAD YARDING

I. Method

One of the most important and efficient units in this operation is a Cletrac "80" with a set of double drums mounted at the rear for high-lead logging. With this machine it is relatively simple and cheap to move to a new location and build up decks. The operation of this machine results in shorter hauls and a saving on main line and haul-in costs, and practically eliminates fire hazard.

The manner in which the system is worked is very simple. While the "tractor donkey" is rigging up and starting to build up a cold deck, the caterpillar "60" chunks out a road to the new set up. Sometimes it isn't necessary to do this, as a spar tree is rigged up next to the railroad track, and the logs are loaded directly from the deck onto trucks by a railroad heel-boom crane.

II. Locating the Setting

The logging boss goes through a tract of timber and decides first where he will place the tractor unit and marks the spar trees so that the fallers will not fell them. The timber is then felled to lead into the spar pole.

The "tractor donkey" unit then moves into the setting, the first operation being to tie the unit down. This is done by locating a convenient stump, which is sawed off close to the ground so the tractor can back over it.

A cable is attached to both ends of the main drum shafts, and this line is then run under several tree roots and tightened, the drums being used for this operation. When the cable is tight enough, it is spiked to the stump, and the unit is ready to rig up.

III. Rigging the Tree

A. Method

The high climber first climbs to the top of the spar tree, taking a 3/8" manila pass line, which is used to hoist the pass line block and strap. These he makes fast to the top of the tree. The manila rope is then threaded through the block, and the end is lowered to the ground. There a 1/4" strawline is attached, and it is pulled up through the block and back to the drum.

After the pass line block is hung, the next step is to set the guy lines. The lines are hoisted into position by the pass line and are made fast to the tree near the top. Then they are made fast to notched stumps and pulled tight by the tractor drums.

The main line blocks and the haul-back blocks are hung in the same manner as are the guy lines. These blocks are located as high as possible on the spar pole so as to get the full effect of a high-lead system. The lines are strung the same way as the lines on a regular "donkey" high-lead system are strung.

B. Sizes of rigging

Main line and chokers 1"--6 strands, 19 wires steel core

Haul-back line	1/2"--6 strands,	19 wires	steel core
Guy lines	1"--6 "	19 "	hemp core
Main spar tree block	18"		
Haul-back spar tree block	10"		
Tail tree blocks	12"		

IV. Output

The maximum distance that is logged by the Cletrac "80" averages around 450 or 500 feet, depending upon the shows and character of the ground.

The output per day on this type of set up averages about 50M or 60M feet of timber. This figure depends upon the size of the timber being logged and the type of country.

V. Organization of the Crew

The following men are necessary to run this set up.

Hooktender	High climber
"Cat skinner"	Chaser
Rigger	Three choker setters

VI. Equipment

A. Two R D 8 Diesel Cletracs, equipped with Pacific Car Co. yarding drums and necessary "cat" logging equipment.

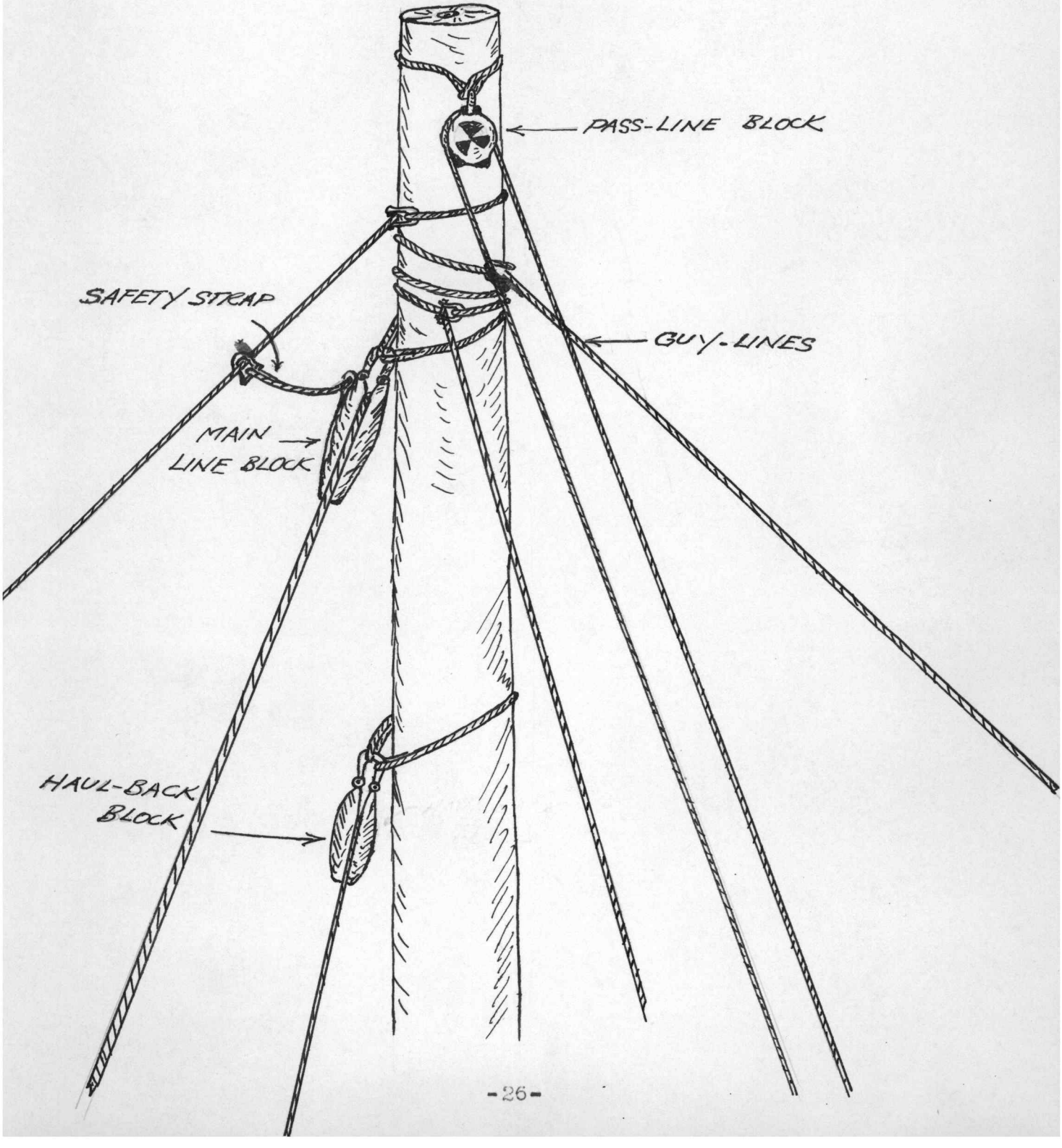
B. One Caterpillar "60", equipped with a Le Tourneau "Bulldozer". This machine is used mainly for building roads and chunking out for roading and swinging set ups.

VII. Cost

Cost of operating this unit is determined by the following factors.

Labor	
Hooktender	.06 per M
"Cat" driver	.07
Rigger	.05
Choker setters(3)	.12
Chaser	.04½
High climber	.05
Wire rope	.15
Maintenance	.30
Supplies, fuel, etc.	.10
Powder	.01
Miscellaneous	.04
Total	.99½ per M

RIGGED SPAR TREE FOR HYSTER COLD-DECKING



TRACTOR ROADING

I. Method

Considerable tractor roading, or skidding, is done by this operation. It is a quick, cheap, and flexible method of logging. Roading consists of yarding the logs from the woods to a hot deck from where they are swung directly to the landing. The hooktender lays out his roads with the "60" and then logs off the area with the R D 8's.

This method is used only when an area has been logged off around a "donkey" setting in a radius of the length of the lines (900' to 1100'). Then using the "donkey" high-lead system as a swing, all the logs are logged, or roaded, off the remainder of this area. The method saves the cost of an added "donkey" setting. In some cases we were roading a distance of 1500' and swinging a distance of 2000' with logging machines. The total distance that the logs were being transported to the landing being about 3500'.

II. Output

With this combination of two "cats" and a "donkey" swing, the operation gets as much as 100M feet of logs per day when logging conditions are good.

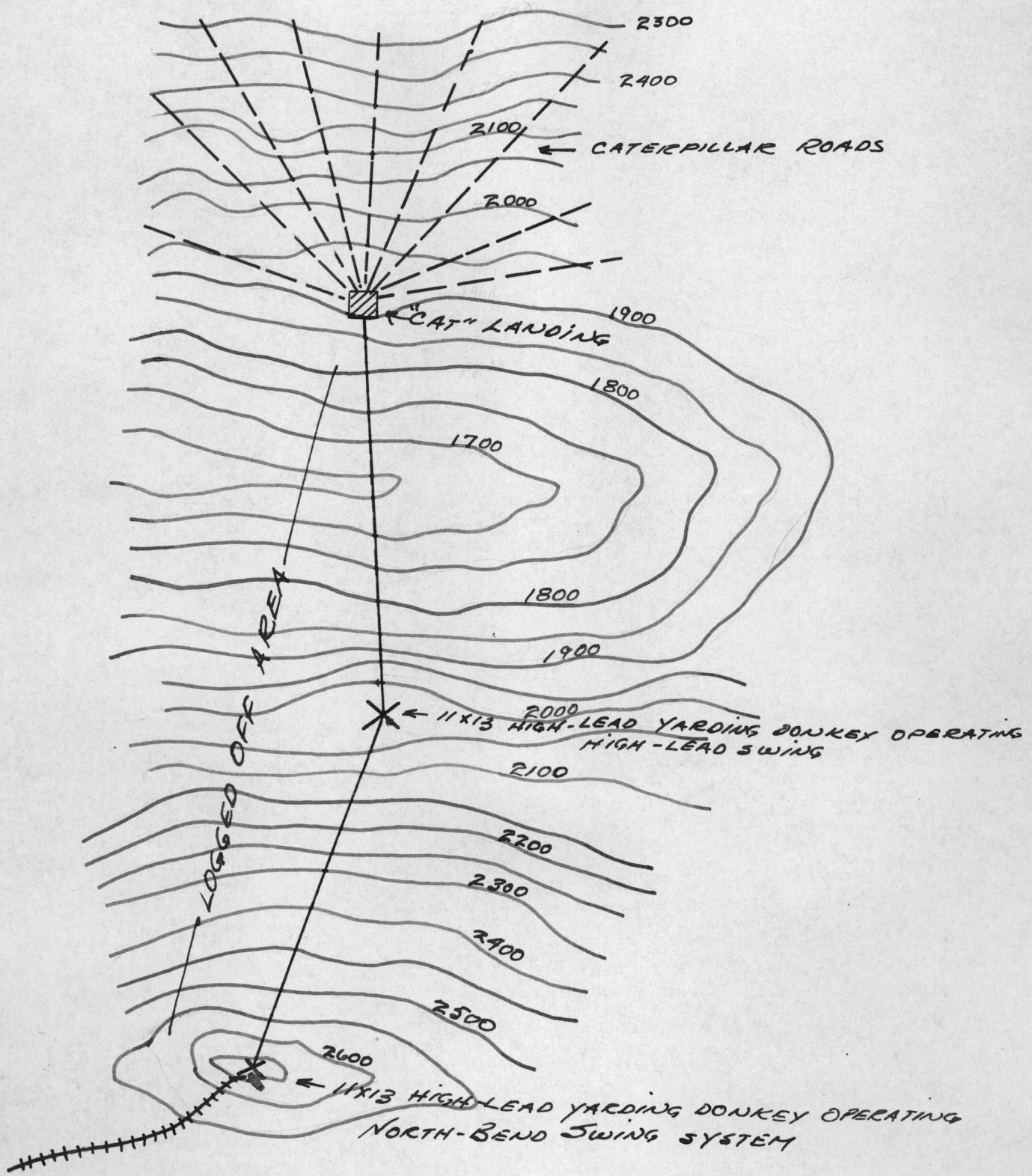
III. Organization of the Crew

The crew consists of the following men.

Hooktender "Cat" driver for bulldozer

"Cat" driver Four choker setters

Rough sketch to show how tractor roading was worked in conjunction with two swing set-ups; one high-lead, one North Bend swing. (Sketch is not drawn to scale.)



IV. Cost

Following factors determine cost of operating this unit.

Labor	
Hooktender	.06 per M
"Cat" drivers(2)	.12
Choker setters(4)	.16
"Cat" driver for bulldozer	.05½
Wire rope	.07
Maintenance	.40
Supplies, fuel, etc.	.09½
Total	.96 per M

Note: This cost does not include fixed charges.

CATERPILLAR OPERATING COSTS OR MACHINE RATES

	Charge/ Season	Charge/ Day
I. Fixed Charges for Operation	(Life 5 yrs. @ 260 days/year)	
A. Depreciation		
Initial cost -- $11,000 per unit.	$2,000	8.46
(Including drums, bull-dozer, etc.)		
Life of unit-- 5 years.		
B. Interest		
Average annual inv. $\frac{I+D}{2}$ x 7%	462.00	1.77
$\frac{11,000+2200}{2} = 6600$		
C. Fire Insurance-- 3/4% of annual inv.	49.50	.19
D. Other Risks-- 4% of "	264.00	1.15
E. Taxes-- 2% of "	132.00	.50
		14.07

II. Operating Charges

A. Supplies

Diesel Fuel--------- 50 gal. at .07 per gal.	3.50
Oil ---------- 1 qt. at .15 per qt.	.15
Grease ---------- 5# at .07 per #	.35
Wire Rope and rigging	2.25
Misc.	.50
Repair parts (estimated)	.50
	7.25

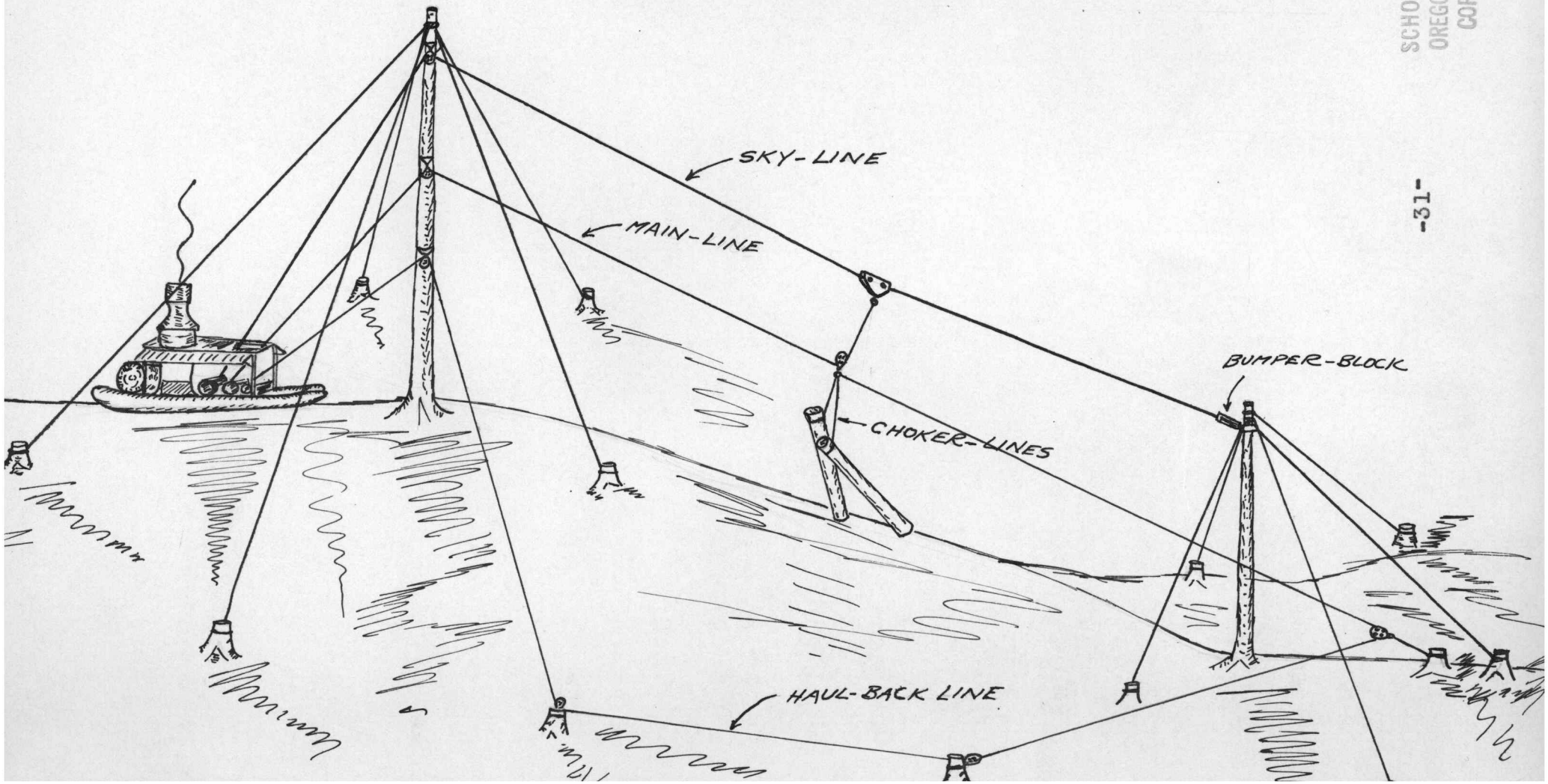
B. Labor for three tractors

3 "cat" drivers at $7.00 per day ------	21.00
5 choker setters at $4.40 per day ----	22.00
1 hooktender at $7.00 per day ---------	7.00
	$50.00
3 "cats" at $21.32 per day ----------	63.96
Total Machine Rate for 3 "cats"	$113.96

Average amount of work done each day-- 100M feet.

$\frac{113.96}{100M}$ = $1.13 cost per M.

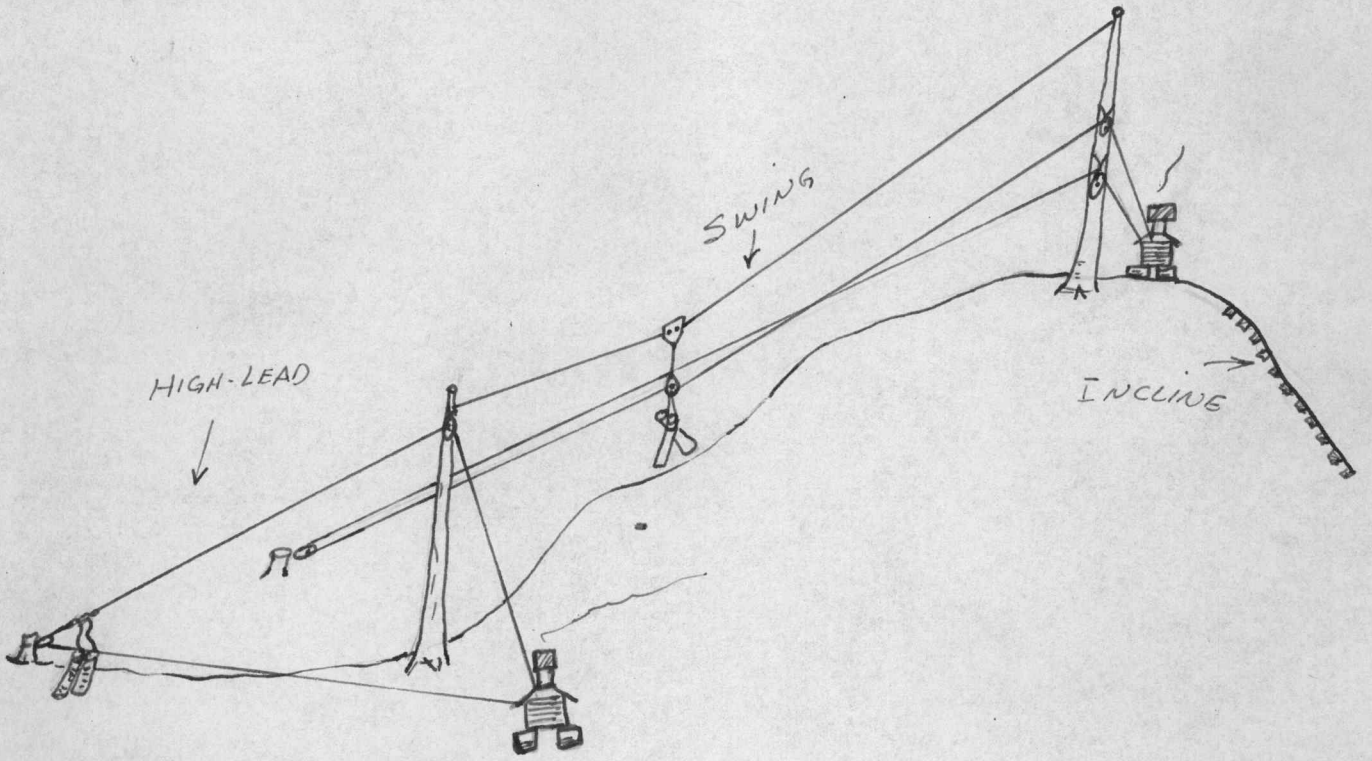
NORTH-BEND SWING



SWINGING

I. Overhead

Because of the roughness of some of the ground in this region, the operation does much of its swinging with the North Bend swing. In one case the superintendent was confronted with the problem of swinging timber 1000 feet up a 45% grade. At the base of the grade he set his high-lead setting; then, using the same spar pole, he rigged a North Bend swing to the top of the grade. With the high-lead system and the swing, the logs were transported a distance of 2200 feet. At the top they were loaded onto trucks and let down a 3300 foot incline by a snubbing engine. More than four million feet of timber was handled in this manner.



II. North Bend System

A. Rigging

A special type of carriage rides a standing line. The line may be stretched from the tail tree to the spar tree and then be anchored to stumps, or it may lead from a drum on the engine. A set of block and tackle is used to tighten the line, which is neither raised nor lowered when the system is lowered.

The haul-in line is attached to the carriage. Between the carriage and head tree, in the bight of the line, a lead block is hung. The haul-back line is run out along the strip, from 100 to 200 feet from the main line, and is attached to the carriage.

B. Equipment

1. Engine used is an 11 x 13 high-lead yarder.
2. Lines used are:

Standing main line	2"
Haul-back line	7/8"
Haul-in main line	1 1/4"
Choker lines	1 1/4"

3. Carriage has two sheaves and is strongly constructed. On the bottom is a large hook on which lines may be hung. (See section on blocks.)
4. Blocks are practically the same as those used in high-lead yarding.

C. Output

Sometimes as much as 120M feet of timber is hauled by this system per day. The output depends upon the prevailing conditions, such as the size of logs, amount of line and "donkey" trouble, and number of logs per turn.

D. Cost

The cost of overhead swinging depends upon the volume of the logs being swung, distance of swing, and time per turn. Cost is also determined by the following factors.

Labor			
Engineer	.05 per M		
Fireman	.04		
Wood bucks(2)	.07		
High climber	.02	(.02 yarding	.02 loading)
Hooktender	.02½	(.02½ "	.02½ ")
Chasers(3)	.13½		
Pumpman	.01	(.02 "	.01 ")
Wire rope	.10	(.15 "	.05 ")
Oil	.02	(.02 "	.02 ")
Wood	.04	(.04 "	.02 ")
Water	.03	(.03 "	.01 ")
Fire	.01	(.01 "	.01 ")
Powder	.01	(.01 ")	
Rig-up	.05	(.05 "	.02 ")
Maintenance	.20	(.30 "	.10 ")
Miscellaneous	.05		
Total	.87 per M		

III. High-lead Swinging

A. Method

Considerable swinging is also done with a high-lead rig-up. The high-lead swing is used only in conjunction with caterpillar logging. The principle in high-lead swinging is the same as that in yarding, except that a swing road is built by blasting out stumps, etc.

B. Output

Output averages from 100 to 110M feet per day, depending upon size of timber and swinging conditions.

C. Cost

The cost for high-lead swinging is averaged at .80 per M and is determined by the following factors.

Labor			
Engineer	.05		
Fireman	.04		
Wood bucks(2)	.07		
Chasers(3)	.13		
High climber	.02	(.02 yarding	.02 loading)
Pumpman	.01	(.02 "	.01 ")
Hooktender	.02½	(.02½ "	.02½ ")
Rig-up	.05	(.05 "	.05 ")
Wire rope	.15	(.10 "	.05 ")
Maintenance	.20	(.30 "	.10 ")
Powder	.01	(.01 ")	
Fire	.01	(.01 "	.01 ")
Miscellaneous	.05		
Water	.03	(.03 "	.01 ")
Oil	.02	(.02 "	.02 ")
Wood	.04	(.04 "	.02 ")
Total	.90½ per M		

LOADING

I. Method

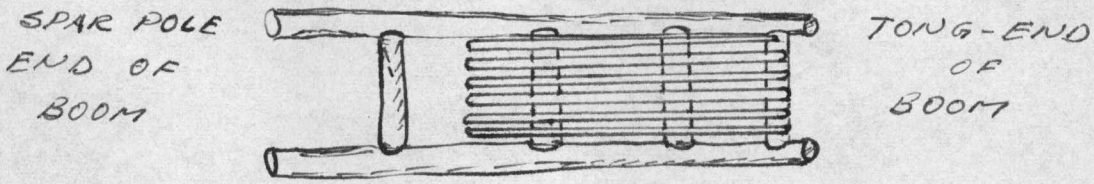
There are a number of loading methods used by different operators. A small outfit that logs on an average of 100M feet of timber per day finds a heel-boom loader the most efficient type and lowest in cost to operate. This operation uses a heel-boom exclusively for all sides. Even the locomotive crane is equipped with a heel-boom. Experience has proven that it is advantageous to use this type of loader because of the following factors.

1. Size and type of timber being logged.
2. Cheap cost of loading with this method.
3. Speed and ease with which a heel-boom loader may be handled.
4. Ease with which the boom may be moved from one spar pole to another.
5. Lower labor costs.

II. Construction of Boom

The boom consists of a pair of heavy timbers approximately 10" in diameter and 50' long. These two timbers are placed 4' apart and braced about every 10' with 8" timbers. From the tong end of the boom to about 2/3 of the way from the tong end, 30# rails are laid parallel to the boom timbers and spiked to the braces. The purpose of this type of construction is to give a sturdy heel to the boom. The whole boom frame is cabled and spiked with bolts.

Sketch showing boom construction



III. Stringing Lines and Hanging Boom

The boom is hung in place by a logging engine, the forked ends on the rear of the boom being fitted around the spar pole. The boom is usually hung about 6 or 7 feet from the base of the tree. The haul-back line is run from the haul-back drum on the engine through a block near the top on the head spar tree, then through a block strapped on a stump some distance from the pole and directly opposite the boom. From this block on the stump the line is spiked to the end of the boom.

The counter-balanced line, which returns the boom, is spiked to the other side of the boom opposite the haul-back line and is then run through a block strapped to a stump opposite the haul-back stump. From this stump the line is passed through a block near the top of the pole and is run parallel to a guy line.

This guy line has a small carriage to which the counter-balanced line is attached. The carriage has one or two medium sized logs hung from it so that a counter-balanced weight is made to return the boom. The main line is run from its drum on the engine, through a block on the head spar tree, to a block on the end of the boom and then to the tongs.

IV. Operation

The head loader places the tongs off center on the log to be loaded, so that the short end of the log will heel against the boom. The main line lifts the log, and the haul-back line swings the boom into position over the car; then the main line lets the log down. After the log has been set in position, the second loader unhooks the tongs, the haul-back is slackened,and the boom is returned to its original position by the counter-balanced line.

V. Output

With the heel-boom loader the operation loads from 10 to 14 cars per day, depending upon the size of the logs and the availability of good bunker logs. The average load is 9500 feet of timber.

VI. Equipment

A. Lines

Haul-back line	7/8"
Counter-balanced line	7/8"
Guy lines	1 1/2"
Main line	1 1/4"
Boom swing lines	1 1/4"

B. Blocks

Four 12 x 2 boom swing blocks

One 14 x 2 loading block

C. Other equipment

One pair of 24" loading tongs.

One 14 x 2 carriage jack with tong line attachment.

VII. Organization of the Crew

The operating labor constitutes the heaviest item of expense, as the men are paid a good wage because they must be particularly skilled. The following men work in conjunction with a loading boom.

Head loader	Loading "donkey" engineer
Second loader	" " fireman

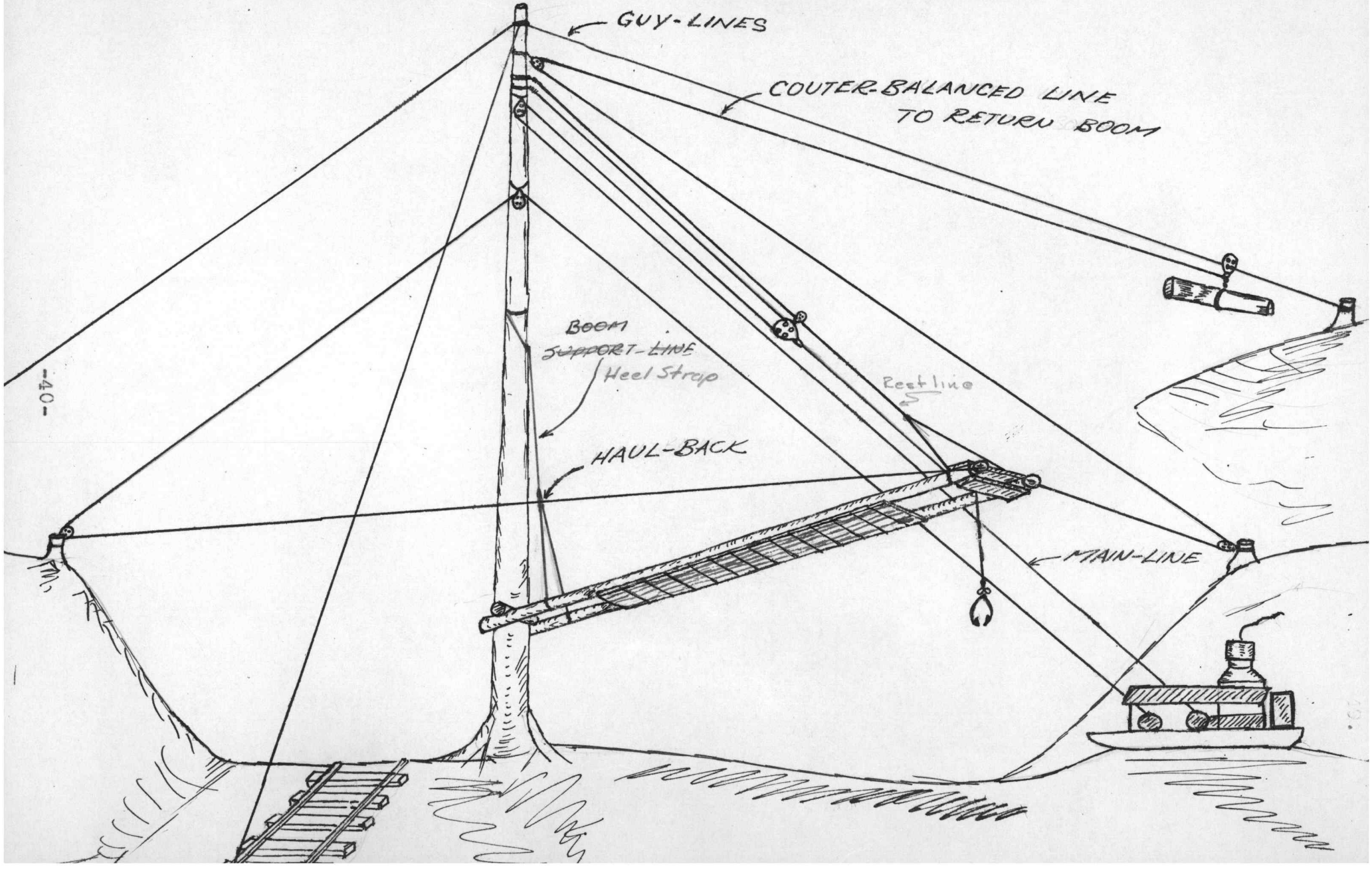
VIII. Cost

The loading cost consists of the following items.

Labor					
Loaders(2)	.12 per M				
Hooktender	.02½	(.02½	swinging	.02½	yarding)
Engineer	.05				
Fireman	.04				
High climber	.02	(.02	"	.02	")
Pumpman	.01	(.01	"	.02	")
Maintenance	.10	(.20	"	.30	")
Wire rope	.05	(.10	"	.15	")
Wood	.02	(.04	"	.04	")
Oil	.01	(.02	"	.02	")
Water	.01	(.03	"	.03	")
Fire	.01	(.01	"	.03	")
Rig-up	.02	(.05	"	.05	")
Total	.48½ per M				

SWINGING BOOM OR ~~HAY RACK~~ LOADER

Heel-Boom



INCLINES

I. Method

This operation frequently employs a single line incline in transporting timber from a higher elevation to the main line. A snubbing engine lets the loaded car down the incline and with the same line pulls up another set of trucks. This engine has 12" x 14" cylinders and a 72" boiler. The main drum is fitted with a 10" shaft with a special type of brake. The line used is a 1½" 6 x 19 hemp core.

The incline which was in use this last summer was 3300' long and had an average grade of 33%. One stretch of 500' near the top on the incline had a maximum grade of 50%.

II. Output

The number of cars let down this incline averaged from 10 to 12 per day. Average load was about 9000' of timber per car. A round trip took from 25 to 30 minutes for a load to be lowered and a set of trucks returned. This time included unhooking and hooking of trucks.

III. Cost

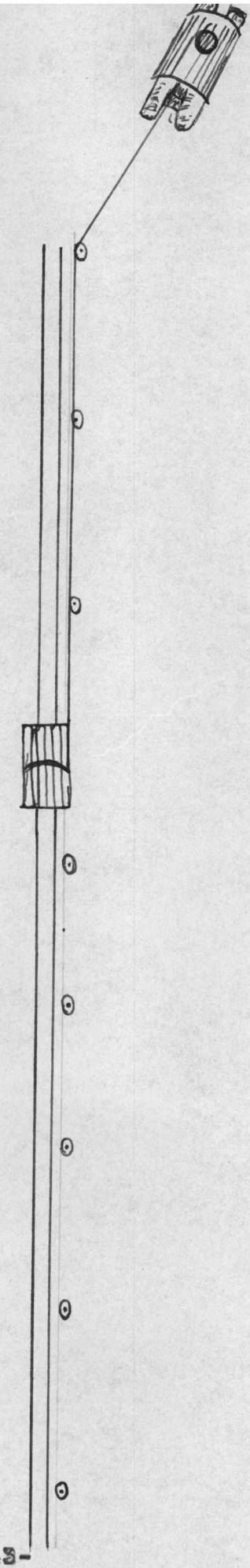
The average cost of constructing an incline, including grading and laying of steel, is $1.00 per lineal foot. Operating cost is determined by the following factors.

Labor	
Engineer	.05 per M
Fireman	.04
Brakemen(2)	.09
Wire rope	.04
Water	.01
Maintenance	.04
Oil	.01
Wood	.01
Miscellaneous	.03
Total	.32 per M

SINGLE-LINE INCLINE

The snubber lets the full cars down and brings up a set of empty trucks.

This type of snubber system is the principal type used by this operation.



At the present time this operation has approximately 30 miles of railroad track, including spurs and main line. All of the timber logged is transported by rail.

As the section crew worked all summer laying new steel, I was able to get considerable information on the construction of logging railroads, which represent a large and important investment.

I. Construction of Railroad

A. Location

The location of the main line and spurs is one of the most important steps in a logging operation. A mistake in location may spell disaster.

Factors to be considered when locating a line are as follows.

1. Amount of timber to be handled.
2. Length of time line is to be used.
3. Amount of traffic that is to pass over the line.
4. Speed with which timber is to be removed.
5. Type of rolling equipment and motive power used.
6. First costs of building road.

B. Rights of way

At least 20% of this railroad was built over privately owned land. Purchasing rights of way meant an added expense.

C. Grades and curves

The construction of grades and curves vary with the character of the road, type of motive power to be used, and the length of timber to be taken out.

The maximum grade is 3%, and the maximum curve is 20° on this road. 50% of the road is an adverse grade, which does not exceed 2½%.

D. Trestles

On the main line, trestles have been used where they have been found to be cheaper than fills, even though a replacement is necessary after a period of 15 or 20 years. On the spur lines, trestles are used except where minor fills can be made. All trestles are of the frame-bent type.

The cost of building a trestle ranges from $2.50 to $5.00 per foot, depending upon the following factors.

1. Height
2. Length
3. Type of soil
4. Type of trestle

E. Crossties

The number of ties per mile depends upon the following factors.

1. Character of the roadbed
2. Size of the rail
3. Weight of locomotive
4. Grade of ties

On the average about 15 ties are used to a 30' rail.

Sawn ties are used exclusively. The size of ties used is 7" x 8" x 8'. On the main line all #1 ties are used, but on spur lines and inclines #3 and cull ties are used.

F. Rails

It has been found that the use of heavy rails pays in the long run because they depreciate less in use, and they can be used on poor roadbeds with less ties.

60# rails are used. They are bolted together with angle-bars and fastened to the crossties with 5½" spikes.

G. Laying

Steel laying is all done by hand. The operations are:

1. Loading the ties, rails, etc.
2. Unloading and placing in position
3. Jointing the rails
4. Ballasting

H. Cost

Total cost per mile of laying this road was averaged at $15,500. This figure including the following.

Engineering + Supt.	$ 400
Construction (Clearing right of way, grading, etc.)	5,600
Trestle building	2,000
Track laying } probably include cost of steel, ties, etc, etc.	3,000
Ballasting	4,500
Total	$15,000 per mile
	15,500

II. Equipment

A. Locomotive

At present the company is operating two rod engines. Both are built by the American Locomotive works. The large engine weighs 115 tons and was built in 1928. The smaller engine, which weighs 65 tons, was built in 1900. Although these engines are wood burners, they can both be changed to fuel-oil burners. The operators have found it much more economical to burn wood.

The large engine is used for yard switching and hauling logs from the operation to the mill. The small locomotive is used to take the loggers to and from work each day, and to haul equipment and supplies to the operation. In other words, it is a general utility engine.

B. Cars

This operation uses railroad trucks consisting of two pairs of wheels upon which is set a steel frame. A steel swivel bunk 9½' long is mounted on the frame between the pairs of wheels. Steel bunk blocks, tied on with chains, keep the logs from slipping off the bunks. Trucks are equipped with hand brakes and automatic couplers.

Forty sets of trucks are kept in operation. The carrying capacity ranges from 60,000# to 75,000#. Logs of equal lengths are selected for a given load.

C. Other equipment

The operation also employs the following.

1. Two speeders
2. Two tank cars
3. Four flat cars for construction

III. Operation

On the average only 15 cars are taken from the woods each day. The 115 ton engine takes out 15 empties in the morning and returns to the mill with 15 loads in the afternoon. The average amount of timber hauled out in this manner runs around 110M feet per day.

In this operation one locomotive is sufficient as far as the hauling and switching are concerned, but the small engine is necessary to aid the construction crew.

The fuel cost is low as all wood is used. The tenders are filled during the night at the mill, and one tender full of wood lasts for a whole day's run.

IV. Crews

A. Crew for 115 ton locomotive

Engineer	Head brakeman
Fireman	Second brakeman

B. Crew for 60 ton locomotive

Engineer

Fireman

Brakeman

V. Cost

Cost per M for the total railroad operation is as follows.

Hauling crew	.06 per M.
Maintenance of main line	.10
" " spur lines	.04
" " logging cars	.20
Depreciation---main line	.37
Train operation on main line and spur lines	.70
Depreciation---R.R.equipment	.08
Total	$1.55 per M

DETAILED ANALYSIS OF LOGGING COSTS

January 1 to March 1, 1937

Per M feet board measure.

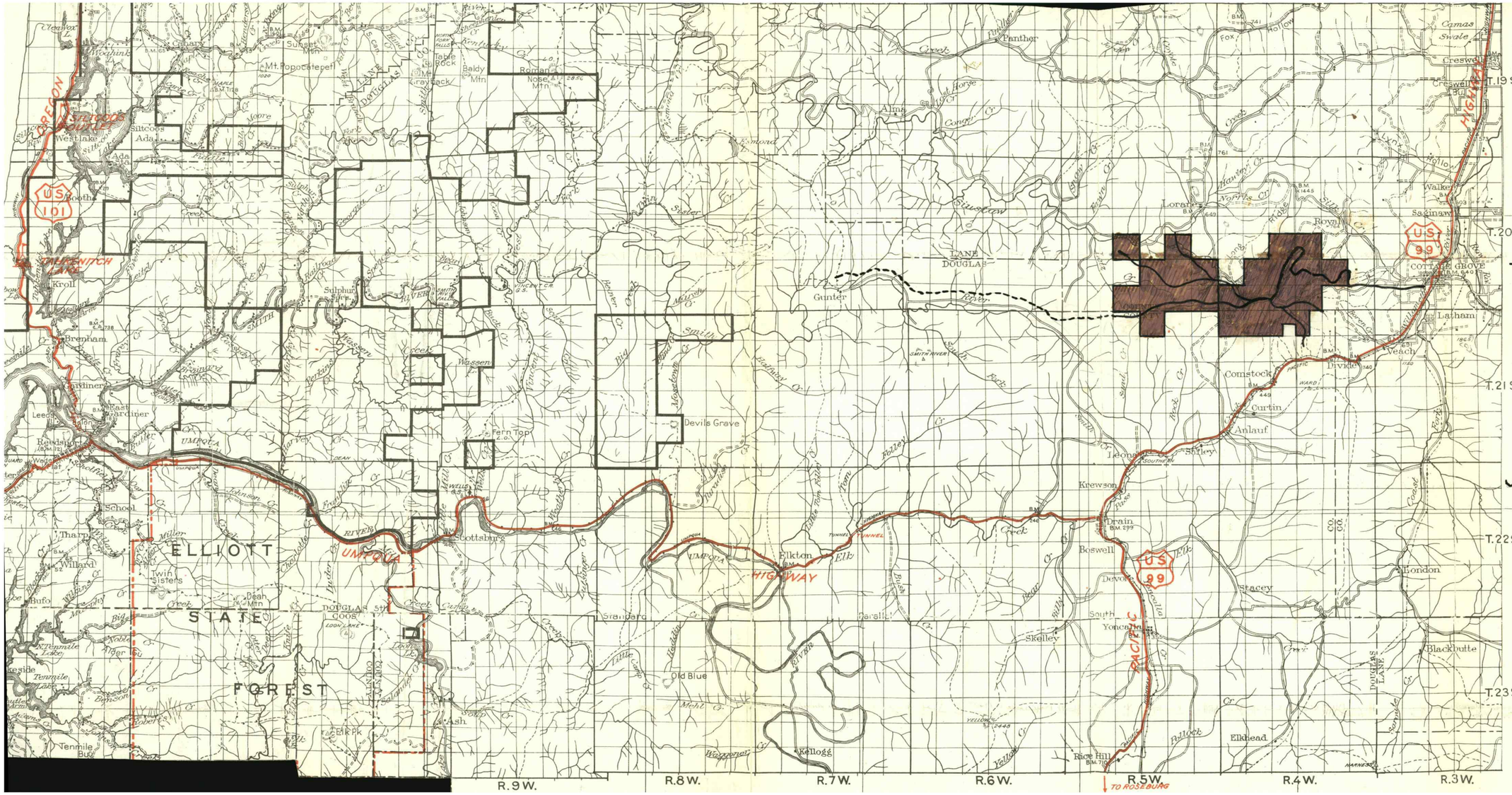
Note: Interest and taxes are not included. Also Stumpage

When incline is used, add .32 per M to each.

Woods Cost	"Donkey" logging	"Cat" logging
Falling and bucking	$ .82	$ .82
Rigging ahead	.12	.07
Yarding	1.20	.94
Loading	.48	.48
Swinging	.88	.88
Wire rope	.30	.12
Fuel and supplies	.12	.09
Total	$3.92	$3.40

Railroad Operation		
Hauling crew	.06	.06
Maintenance main line	.10	.10
" spur line	.04	.04
" logging cars	.20	.20
Deprec. main line	.37	.37
Train operation	.70	.70
R.R. equipment deprec.	.08	.08
Total	$1.55	$1.55

General Logging Expense		
Supervision	.10	.10
Industrial insurance	.11	.09
Other insurance	.06	.05
Fire protection	.05	.03
Deprec. logging equip.	.15	.15
Shop	.15	.10
Scaling	.05	.05
Office expense	.04	.04
Miscellaneous	.09	.09
Total	$0.80	$0.70
Grand Total	$6.27 per M	$5.65 per M


SURVEYED LINE
MAIN LINE
SPUR LINE
CUT-OVER LANDS
LOGGING AREA
OF
J.H. CHAMBERS and SON
COTTAGE GROVE
T.19 S.
T.20 S.
T.21 S.
T.22 S.
T.23 S.
R.9 W.
R.8 W.
R.7 W.
R.6 W.
R.5 W.
R.4 W.
R.3 W.
TO ROSEBURG
ELLIOTT
STATE
FOREST
UMPQUA
HIGHWAY
PACIFIC
LANE
DOUGLAS
COOS
Devils Grave
Fern Top
Gunter
Elkton
Scottsburg
Drain
Boswell
Yoncalla
Skelley
Kellogg
Old Blue
Elkhead
Rice Hill
Cottage Grove
Creswell
Saginaw
Walker
Lorane
Royal
Comstock
Curtin
Anlauf
Leona
Sitley
Krewson
Devore
South
Stracey
London
Blackbutte
Latham
Veach
Divide
Brenham
Gardiner
East Gardiner
Reedsport
Wedderburn
Leeds
Sulphur
Wassen
Sitcoos
Westlake
Ada
Kroll
Tenmile
Tenmile Lake
Twin Sisters
Deah Mtn
Bufo
Willard
Tharp
School
Mt. Popocatepetl
Baldy Mtn
Table Rock
Roman Nose Mtn
Sunset Mtn
Woolpink
Cleawox L.
Camas Swale
Panther
Alma
Sweet Horse Cr
Esmond
Wasson
Ash
Granberg
Fairgrounds
Elk
Big
Smith
Umpqua
Tunnel
Tunnel
Tunnel