SEMINAR THESIS.

" PINE LOGGING IN THE WESTERN STATES. "

Respectfully submitted
by
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INDEX.

"Pine Logging in the Western States."

A subject of this kind, from the very nature of the things involved must be broad in its scope. I will not try to go into details on all of the methods used in logging, but will endeavor to bring out the most economical and efficient methods now employed. The logical way of presenting such a subject would be on a comparative cost basis, with all of the factors entering into logging costs included. However, logging costs are a rather delicate subject, in a great many instances and are not always available.

General Cost Factors.

Overhead charges.

Overhead charges include all current expenses which are not directly chargeable to any particular step in the operation; that is, expenses which apply to the entire operation. This is not strictly true of certain items such as taxes and insurance, for the lump sum in which they are paid can be divided into proportional shares for each item in the operation. Such is not the common procedure, however. Overhead charges are ordinarily computed upon the basis of each thousand feet of lumber shipped and may then be applied to each thousand feet log scale.

Cruising and the lay-out of the logging operations are the first items of overhead costs met with. In private operations cruising is usually done at the time of purchase and may be considered an additional cost of stumpage. Most of the lay-out of operations is covered by general superintendence, woods supervision and engineering.

Fire protection is a charge for carrying stumpage rather than for logging except in special cases where protective measures are taken for machinery, chutes, trestles, cables, camps and the like.

Taxes on standing timber are frequently considered by lumbermen as an operating cost, but they are logically a cost of carrying stumpage and cannot be considered as an operating cost unless they can be properly proportioned among part of the operation.

Insurance:- Most operators carry their own risk because they cannot comply with the requirements of the fire insurance companies without making an impossible increase in their investment. Liability insurance covers all the employees and provides certain compulsory payments in the case of injury or death of an employee. In most states where this law operates, this insurance may be placed with any insurance company, provided the claims are paid as directed by the State Industrial Accident Commission, or the employer may insure under the State Compensation Insurance Fund. The rates for state and private insurance are the same and are fixed in certain amounts for each hundred dollars paid out in wages. This liability insurance is a comparatively recent social and economic development and is being subjected to many improvements.

Selling:- In the case of a loggong operation distinct from the milling, the selling of logs may be done directly by the manager or in the case of a sales manager or sales agency being used, the costs incidental thereto constitute an overhead charge.

Office and General Expenses:- These include all clerical help, stationary, upkeep of office buildings, dues and other miscellaneous expenditures necessary in the conduct of business.

Superintendence:- General managers and all others not directly chargeable to some phase of logging constitute an overhead charge.

Depreciation:- All improvements and equipment used in lumbering depreciate in value, and sufficient money must be taken from the business during its course to pay this loss. A sufficient amount may be taken out annually to form a sinking fund, which with compound interest will equal the depreciation, or the depreciation may be made to equal a fixed per cent annually of the residual value of the investment or its value less previous depreciation. By this means, depreciation expenses are the heaviest in the earlier years and steadily diminish each year. The common method of figuring depreciation against a stand of timber is to determine the total depreciation involved in its exploitation and by prorating this total over the stand to determine a figure per thousand board feet. The depreciation per thousand may then be applied to the annual cut to determine how large an annual sinking fund is necessary. Railroads which can be used for additional timber have a residual value at the end of the operation much greater than the salvage value. Improvements and equipment which cannot be used any further have only a salvage or wrecking value. The wrecking value of rail-roads which cannot be used in place for any further purposes is the sole value of the rails for relaying. The rails commonly have a life of from fifteen to twenty years; the former when they are lifted out and relaid every year and the latter for more permanent use. Geared locomotives, with proper maintenance and repairs, are good for about twenty years service. During that period the boilers must be repaired at least once. A rod engine under similar circumstances has a life of about twenty-five years. The sale value of second-hand logging donkeys and similar equipment is very low. In first-class condition they will only bring about thirty per cent of the original factory price.

and after five or six years use the donkey engines can no longer be put into first-class condition and the wrecking value is even less. In some cases they may be used for about nine or ten years service, but if not worn out in ten years they are obsolete in type.

The above items apply to overhead charges which constitute in the main, fixed annual charges.

Other items affecting costs.

Topography:- Topography and accesability are terms so near alike that little distinction can be made. It takes very little imagination to visualize the added logging costs due to rough land over the lower cost of logging comparatively smooth ground.

Climatic conditions affect the log output considerably. During rainy, slushy weather or in excessively hot weather labor slackens up and there is usually a greater labor turn-over with a like drop in production.

Labor Efficiency:- Satisfied, efficient labor is an asset to any operator and is becoming more understood as time passes. It is no uncommon thing to see several dissatisfied and poorly trained employees doing what one satisfied and properly trained man should do. Proper regard for the rights, happiness and health h of employees makes for a better understanding between employer and employee and considerably affects production.

Types of machinery and its care:- Many operators with small working capital employ cheaper and less efficient machinery. Their costs are of course higher in the long run. The lack of care given machinery is not confined to the small operator, however. Many men operate their machines to their de signed capacity. A machine is much like a human organism, it also has a reserve energy which it is quite proper to use in an emergency, but making a practice of using it will soon wear out the best of them and cause either a total wreck or continuous repairs. Unskilled or careless mechanics, improper lubrication, delay in replacing worn out parts and working the machine to its fullest capacity all contribute to its downfall in short order and so increase the operating costs.

Logging Methods:- Many operators cling to the methods that they know best when in reality a different method and in some cases different types of machinery would lower their logging costs. to a point where the change would pay big dividends.

Markets:- Easy access and a steady demand are ideal conditions sought by every business. In logging, however, the tendency is to be drawing away from the centers of population and the sources of greatest demand and following the virgin timber stands away from the lowlands to the foothills and on into the more mountainous regions. This entails added railroad construction, different types of machinery and usually added logging costs. Long freight hauls and market fluctuations add considerably to logging costs.

Managerial ability:- In every line of business managerial ability plays a decidedly important part. A business without proper management is like a rudderless ship at sea and drifts ultimately onto the rocks. Engineers and other proffessional men may be made but a real executive or manager must have not only these inherent qualities of leadership, foresight and ability but he should also have an ability to pick men for the jobs they are best fitted for without fear of predujice. Too many men occupy the place of manager whose only claim to such a position is that they are a friend to the owners thirty-first cousin.

Taxes:- The way forest property is now taxed, it precludes any plan whereby perpetual operation may be put on a business basis. Some momentary sacrifice must be made by both State and private owners of timberlands if the future of the lumbering industry is to be put on a permanent basis. At any rate revenues would only be deferred until a later date and the future needs of the nation assured.

Insurance:- At the present time, insurance must be carried in most cases by the operators them selves and constitute an extra cost. Timber insurance is the product of a well regulated forestry program.

Camp Costs:- In most camps at the present time, the cook house is not on a paying basis. This loss is charged to logging generally and is considered a necessary evil by most loggers, in order to keep the employees satisfied and contented.

Depreciation of machinery and equipment:- There are a number of good methods for taking care of depreciation, two of which were mentioned under overhead expenses. The depreciation of lines is a quantity that cannot be accurately counted. With lines there is a great variation in their manufacture and even more in the way they are handled. Most companies make a flat charge of from thirty to sixty cents per thousand B.M. and at the end of the year this estimate is checked and due allowance made for any under-charge or over-charge.

Roads and railroads:- Railroads are constantly becoming a heavier burden on logging costs due to the more inaccessible regions where timber in paying quantities is found. Roads and railroads in the pine region are not as much of a burden to the loggers as those in the fir regions as their pine timber is nearer to the main line railroads and lighter construction work is needed.

Quality and stand per acre:- Quality and stand per acre have a great effect on logging costs because it is just as cheap to log a number one log as it is to log a cull. With a good stand per acre it is possible to have more logs come into one landing, eliminating costly moving.

Various Methods of Logging.

All of the logging methods employed in the Douglas Fir regions are employed in the pine belt with numerous adaptations to this particular type of logging. The pine and the fir logger have very few logging problems in common. The latter, as a rule, is working in virgin stands of from fifty thousand to one hundred thousand feet B.M. The topography is mountainous and special heavy duty machinery and equipment must be employed for fir logging. His railroad construction costs range from seven thousand to seventy-five thousand dollars per mile, while the pine logger is operating in stands averaging twenty thousand feet per acre. The topography is level or slightly rolling and rarely rough. The average slope is about twenty per cent. Rail-road construction costs run from five hundred to eight thousand dollars per mile. The most difficult construction problems have to do with the crossing of the deep rock gorges which are common in some parts of the pine belt. The methods most commonly used for pine logging are steam logging by both high lead and skyline, caterpillar or tractor logging, by truck or by horse.

Logging operations vary in size, their daily output ranging from 20,000 to 500,000 feet. An operation may consist of one or several camps. In any case, however, the camps are near each other, have a common ownership, and are supervised by the same head. A camp may be made up of one or more sides, a side consisting of the crew and machinery necessary to handle the logs from one yarding engine. Where a number of engines are found at a side, each side may constitute a camp. A camp may include as many as four sides when only one or two engines are used at a side. The output of a side, varying as it does with the yarding output, ranges generally from 20,000 to 80,000 feet per day.

Steam Logging.

Powerful steam logging is the most prominent feature of the logging operations of the Western States. The investments in logging plants are strikingly large At present more capital is invested for improvements and equipment in Pacific coast logging operations than in similar operations in any other region of the United States, taking output into consideration. Therefore operators have to plan their work a long time in advance and be conversant with the most approved methods, not to mention mastering the maze of details in any enterprise conducted on a large scale. The work of every department is specialized. each requiring a few technically trained men and a large percentage of skilled workmen. This is made necessary by the size of the operations, the complexity of the methods and equipment used, and the timber-utilization problems encountered.

The term "logging" as commonly used, covers all of the work of handling logs from standing timber to the sawmill.

High-lead Yarding.

High-lead yarding involves no great modification of ground yrding. The lead block is simply attached to a spar tree as high as practible from the ground instead of to a stump, so that the main line tends to lift the front end of the log from the ground. The chief advantage of the high-lead system over the ground system is that there is a lift to the logs as they c come in, so that they are not stopped so much by stumps and other obstacles and travel faster. This advantage is greater the higher the lead-block is fixed, but is lost in practice when the yarding distance exceeds six or eight hundred feet. Another advantage is that the landing is kept free of chunks, tops and trash, a source of trouble and expense with the ground system. The high lead does not require a landing, the resultant saving just about off-sets the extra expense of preparing the spar tree and swinging the lead-block. In addition, yarding may proceed more constantly because the logs delivered at the landing place may be piled one on top of the other for some time regardless of whether loading is going on or not.

In the case of hauling down a steep slope or side-hill work the logs have the same tendency to roll behind the obstructions. However high-lead yarding is especially adaptable to hauling uphill or on level or rolling ground.

Method.

A suitable tree, conveniently located near the track, is used as a spar tree. This tree, after the tip has been cut off at from one hundred twenty to two hundred feet above the ground, is guyed with from six to nine lines to give it rididity, In the case of high spar trees there are usually six guys from the top and three or four from a point near the middle to prevent the tree from buckling. If a double line system of loading is used two additional guys are necessary. A high lead block, with a sheave from twenty-four to thirty-six inches in diameter is hung near the top of the spar tree below the guy line fastenings. The hauling line is passed from the drum of the engine to and through this block and out to the logs to be yarded, the power being furnished by the trip line, as in the case of ground logging.

The older type of yarding machines require a separate loading engine, but in the latest machines the yarding and load-inge engine are mounted on a special steel car with detachable swivel trucks. The machine is run on a spur opposite the main line and by means of hydraulic jacks is raised clear of the trucks and securely blocked. If it is not advisable to build a spur the entire machine is jacked up, short rails placed at right angles to the main line, the trucks placed on these and t the whole lowered and moved into place, where it is securely blocked up ready for operation.

Sky-line or Over-head Cableway Skidder.
Tree rigged type with guy-line leader.

The tree rigged cableway skidder consists of a main cable suspended between a head tree, situated at the rail-road, stream or road engine and a tail tree out in the woods. A skidding carriage, traveling along this main cable, brings the logs in from the woods, dropping them at the head spar. The length of the span depends upon ground conditions, as it is governed by the amount of sag that can be provided in the main cable. In a flat country, spans up to two thousand feet are obtained, while in mountainous districts skidders capable of yarding up to four thousand feet may be obtained, In skidding uphill or downhill or across canyons the contour of the ground often permits much greater sag without increasing the height of the head or tail spars, hence the span can be greater than in a flat country.

The skidding engine can be mounted on a sled when logging to a skid road; mounted on a boat when skidding to a stream or mounted on a car when loading to a rail-road. In the latter case a guy line leader spans the rail-road tracks for loading logs on the cars.

When logging to a railroad the engine car is run out to the setting and located near a tree suitable for the head spar. In some cases a switch is put in at this point and the skidder run on a side track. However, in the usual method, the skidding car has swivel trucks. The car is raised by means of jacks, one being prouded under each corner of the car, until the wheels are raised off of the tracks. The trucks are then tu turned at right angles, temporary rails placed under them, and the car is then moved sideways off the main tracks to its position in front of the spar tree, and it remains there until the entire setting has been cleared.

Method of Rigging and Operating.

A light line, known as the changing line, is run out from the engine up through a block on the head tree, then to and around a shreave on the tail tree, btought back to the head spar and attached to the main cable. The light line is then overhauled by the engine and the main cable is pulled out to the tail tree. The main cable is passed around the tail tree or over a saddle block and made fast to a stump, thus serving as a guy. At the head spar the main cable is run through the skidder carriage and then connected to a cable extension piece by a block and heel tackle. This cable extension passes through a saddle block fastened to the head tree and terminates in a split walking ancherage. After the ancherage is made fast, the slack in the block and heel tackle is taken up by the engine and this pulls the main cable up to the proper sag.

The out-haul line is then taken up through a block on the head spar, run out and passes through the out-haul block on the tail tree, brought back and fastened to the carriage. The skidding and slack pulling lines are then led through their respective blocks on the head spar and through their respective sheaves at the carriage. The leading guym with its block, is then rigged spanning the track and the machine is ready to skid and load logs.

In operation, the outhaul rope draws the carriage out along the main cable when it reaches the place where the logs are to be picked up, the out-haul drum is thrown out of gear and a foot brake applied, holding the carriage stationary. The slack pulling rope then over-hauls the skidding rope and continues pulling slack in the skidding lineso that the tongmen can easily carry the outer end of the skidder line to either side of the cable to the logs to be skidded.

The chokers to which the logs are fastened, are then hooked into the skidding line with the carriage held stationary. The skidding line is drawn in until the logs are brought in under the cable and one end of the log elevated sufficiently to clear obstructions, or if desired the logs may be entirely suspended. The skidding rope is then drawn in and the outhaul rope paid out, the carriage with its load of logs then running into the head tree, where they are dropped ready to be loaded onto the cars. The carriage is then drawn out again by the outhaul rope, other legs attached and the operation repeated.

Method of Changing Cable.

It is not necessary to move the skidding engine and rig up a new head spar for each run. This is done only after the entire setting has been cleared. The tail tree is changed for each run, but very little rigging is required here.

Two methods are in use for changing main cable lines from one run to another. In one method, two main cables are employed. While one cable is operating the rigging crew is getting the other in place for the next run. When all the timber adjacent to the cable which is in operation has been skidded, that cable is dropped and disconnected from the main cable heel block and the other main cable, already placed by the riggers, is run through the carriage, connected and tightened up.

The next tail tree is now selected, a light changing line, selected especially for the purpose, is drawn out from the head spar over the line of the next run, up to and around the newly selected tail tree and from there to the tail tree which has just been discarded. This changing line is then made fast to the outer end of the main cable left lying on the ground on the last run logged and by means of a changing line drum on the engine the main cable is pulled entirely around the newly selected tail tree, bringing it into position between the head and the new tail tree selected for the next run, ready to be connected when required. Thus the main cables are shifted from one run to another by the riggers without interrupting the skidding ope operation.

The head spar is guyed with six top guys and four buckle guys and one loading guy across the track on which is spotted a loading jack. The loading line passes through this jack and is made fast to a pair of tongs. In the case of a duplex loader two loading guys are used with two loading blocks, two loading lines and two loading tongs.

Lidgerwood Portable Steel Spar Skidder.

Logging in pine stands averaging 20,000 feet B.M. per acre necessarily calls for machinery that may be moved readily from one landing to another in a short space of time. The Lidgerwood Manufacturing Company and the Clyde Iron Works have met these obstacles successfully. While the Clyde type of machinery is somewhat different from the Lidgerwood both embody speed, strength and quick moving facilities. The Clyde tree rigged skidder is essentially the same as the Lidgerwood tree rigged skidder, except that the Lidgerwood has a patented interlocking drum, which means that the outhaul and skidding drum are interlocking. The Clyde line of machinery will be treated later.

The Lidgerwood Portable Steel Spar Skidder straddles the track, and the empty cars are drawn through underneath for loading by the swinging boom loader. The capacity of the swinging boom loader is more than equal to the highest capacity of the skidder, which prevents delays in skidding caused by logs being piled up around the machine. This is of special importance in flat or rolling country where a great number of logs must be handled a day, and the logs must be loaded as rapidly as they are brought in. The main skidding engine on this machine has four drums, Viz;- skidding, outhaul, slack pulling drum and a drum for raising and lowering the spar. This skidder also has a four drum utility engine, having two drums for tightening the main cable and heel blocks, one drum for changing lines and the fourth drum for spotting cars. The guys are tightened by four steam operated drums mounted in the tower. This equipment greatly facilitates the work of changing from one setting to anotherand insures this being done in the minimun of time. A three drum loading and swinging engine operates the swinging boom loader. There are in all four sets of double cylinder engines in the equipment.

North Bend Overhead Logging System.

The North Bend system of skyline logging is in very extensive use throughout the Northwest. This is probably due to the fact that it does not require the use of any special type yarder for successful operation.

The carriage travels on the fixed standing line. It has no outhaul line attached to it. The in-haul or skidding line is fastened to the base of the carriage, passes through a fall block, hence through a head block on the spar tree to the engine. By means of the haul-back line the fall block and the bight of the skidding line are carried into the woods. The carriage, floating on the standing line, comes to rest at a position opposite and above the log, being hooked to the fall block. Upon pulling in the skidding line the load has a constant tendency to raise up at the forward end and thus avoid obstructions. It is very efficient means of yarding or swinging where conditions are favorable.

The MacFarlane Skyline Logging System.

The MacFarlane skyline system of logging is a system of hauling logs through the air instead of on the ground. It differs from other over-head cable systems in that no slack line is drawn from the carriage. The standing line, upon which the carriage travels, is raised and lowered in its operation. This system can be used on any kind of ground, but it is especially adapted to steep hillsides.

The rigging consists of a main cable suspended between a head tree and a tail tree. Upon this line the carriage travels. The standing line passes over a special shoe on the tail tree and through a block on the head tree to the engine. Two lines are required to operate the carriage_ one, the skidding line to haul it in and the other, the haul-back to take it out.

In operation the haul-back line hauls the carriage out along the standing line to the point where the log is to be hooked on. The standing line is then slacked sufficiently to lower the carriage to the ground. The choker is hooked to the carriage and the standing line tightened again until the load is raided free of obstructions. Powerful brakes on the main drum of the engine hold the line taut, while the carriage with its load is pulled in. The load is lowered and unhooked, the carriage is returned and the operation is repeated.

Clyde Ground Skidders.

The term "Ground Skidders" refers to machines for skidding logs on the ground. The machine may be mounted on trucks for railroad track, on skids, on crawler traction, or provided with other means for moving over the ground. It is virtually a high lead.

The most economical method of railroad logging under many conditions, is to skid the logs with an independent skidder and load with a separate unit. This system is especially applicable to level or rolling country where the operation requires a sufficient quantity of logs daily to keep a loading unit busy. The result with a loader may be controlled with little, if any variation from day to day. The daily capacity of a skidder is therefore subject to ground conditions, size of timber, stand per acre and varying skidding distances. The daily capacity of the leader is limited only by the capacity of the crew if supplied with logs and cars.

It is practically impossible to synchronize the skidding and loading operations in the average woods with both operations combined in one machine. When the conditions are unfavorable for skidding, the loading unit cannot work its full capacity for want of logs. When the conditions are exceptionally favorable for skidding, the loading crew may not keep up. This necessitates holding up the skidding crew until the logs are loaded. The logical plan then is to have separate skidding and loading units and keep the skidding some ten days in advance of the loading. The average output of the skidder will be sufficient to meet the loading capacity and both operations will be working with no interference by the other at any time.

Clyde Self-propelling Steam Skidder.

This style of skidder consists of s steel platform mounted on railroad trucks of four or six wheels each, for standard or narrow gauge track. The engines and boilers of proper size and arrangement to suit the particular style of machine required are placed on this platform. The engines are connected with the trucks by steel sprocket chain and sprocket wheels for propelling along the track, under its own power.

A steel frame boom of the A-frame type is mounted on one end of the car frame in the case of the single end style, and on each end in the case of the double end style. The top ends of the boom legs are connected flexibly with the steel boom head by means of a buffer spring arrangement to absorb all shocks. Swivel eye connections prouded at the base prevent twisting stresses and complete the flexibility of the entire boom struuture.

The whole equipment of machinery is covered with a skeleton steel cab having a sheet metal roof. The entire outfit, being all steel and iron is fire-proof.

The machines may be classed as follows:- The single end style has one double cylinder engine with boiler placed at the rear. The double end style has two double cylinder engines placed back to back with boilers in the center of the car frame between the two engines.

Four-line double end, operating one skidding line from each end, equipped with two double cylinder engines

Two-line single end, operating two skidding lines from one end, equipped with one double cylinder engine.

Each of these styles are built for horse or cable outhaul Using animal for outhaul the skidding is limited by the speed of the horses which is about three hundred feet per minute. With cable out-haul the usual speed is about five hundred to seven hundred fifty feet per minute, bringing in the logs and about I,000 to I500 feet per minute taking the line back, depending upon the size and style of engine.

The mechanical or cable outhaul machines are equipped with extra drums for carrying a setting line for each outhaul cable. This setting or "straw-line" is usually three-eighths inch wire rope, which weighs only twenty-two pounds per hundred feet, and is used for pulling the outhaul cable around the setting, through the outhaul blocks The small setting cable is easily carried out ahead while placing the outhaul blocks for the next setting thus quickly running out all the outhaul lines at one time.

Each engine is equipped with one decking drum for each skidding line which is used for decking or lining up the logs at the track. This helps out the loading without decreasing the efficiency of the skidding operation or requiring any additional help, because the decking is easily done while the skidding line is out for the next log. In fact, the decking feature really expediates the skidding by clearing the logs at the track out of the way of the following logs.

Each engine also drives two drums for carrying side guying cables and are used for taking up the slack in the guy lines when setting the machines The guy line runs from the drum to a block attached to the side of the boom head and thence to a stump or tree at a convenient distance. When the guy is tightened, the guying drum is held with heavy steel rachets and the drumming mechanism thrown out of gear so that the shafts and guying portion of the machinery are not in motion when the machine is working at skidding logs.

The frame of the Clyde skidder is constructed of heavy steel I-beams and steel angle braces, hot riveted and trussed throughout to withstand sudden and severe shocks to which a machine of this nature is subjected. Two trusses or hog backs of heavy ~~st~~ steel channels are fastened to the frame near the center of each truck to stiffen the frame for carrying the weight of the engines and boilers. These trusses are built into the cab frame thus stiffening the cab as well as strengthening the frame of the machine. Supporting guys from the peak of each boom are ~~f~~ fastened to the top of the trusses.

The trucks are either four or six wheeled according to the size of the machine, the weight of therails and the condition of the track, on which the machine is to operate. The truck ~~wh~~ wheels are 28 inches in diameter and have a five inch tread, shoe brakes are applied to the wheels and are operated by both steam and hand wheel.

Engines:- The best of workmanship and material goes into the manufacture of the Clyde engines as with the Lidgerwood Willamette and Washington.

Each Clyde engine,to handle two skidding lines on a cable outhaul skidder,operates two drums for skidding,two for outhaul,two for line setting,two for decking and two for guying. Each of these drums are independent of the others and operated by adequate frictions of the"V" type,and controlled by levers within easy reach of the operator.

On the larger machines,skidding drums may be equipped if desired with band frictions.The high speed outhaul drums have asbestos composition friction blocks.

The large two line double end machines,especially adapted to some of the western operations,have skidding drums driven at two sppeds:low,at five hundred feet per-minute for the larger logs and high,at one thousand feet per-minute for the smaller logs.This feature increases the daly capacity very materially,as the high speed is used for a majority of the logs handled.Where extra power is needed,the lower speed is available for the emergency.

Propelling:-The usual method of self propelling is through steel sprockets chains and steel sprockets driven by the skidding engines.On double end skidders,the engines are placed facing each other,or back to back,with the boiler between,so that one engine is used for propelling in one direction and the other for going in the opposite direction.On single end skidders the propelling in either direction is accomplished by a reversing mechanism incorporated with the lower propeller shaft.Both trucks in all cases are connected for propelling.

Method of Operating.

No fixed rule or plan for operation can be established that will cover all conditions,because so much depends upon the character of the country to be logged.

With the type of skidders just described,it is customary to lay track for the main line and run out laterals at a proper distance apart to skid the logs at a minimum cost.In some places it is more economical to lay tracks less frequently and skid a greater distance,while under other conditions tracks should be laid closer together and skid shorter distances to produce the best results.The standard equipment,however,usually provides for a maximum yarding distance of one thousand feet.

The relation of skidding distance to frequency of tracks to reduce the ultimate cost to the lowest amount is a matter that works itself out on the ground according to the condition of each logging operation.

These skidders are run out to the setting point under their own power.On arrival at the place where the machine is to work,the brakes are set and the guy lines run out and choked to a stump.The slack of the guy lines is taken up with the engine on the skidder and held with the ratchets and dog.

The outhaul cables in case of mechanical outhaul machines, are run out with the setting lines through snatch blocks placed in proper position to cover the skidding trail, and attached to the skidding line with swivel connections to prevent twisting of the cables. Winding in the outhaul cable carries the skidding line out to the logs at a speed of one thousand feet or more per-minute. Two or more logs may be hooked on with chokers and they are brought in at a speed of five hundred feet per-minute or better.

The logs are turned parallel with the tracks by a separate decking and slewing line while the skidding line is going back for the next turn, without causing any delay to the skidding operation, which greatly expedites and reduces the cost of loading.

When all the logs have been skidded and decked at the landing, the outhaul and skidding lines are disconnected and wound upon their respective drums. The guy lines are detached and run in on their drums. The propelling clutch is then thrown in and the machine moved to the next setting.

The setting lines are run out ahead and outhaul blocks placed in the next setting while skidding the previous setting, so that everything is ready to attach the guy s, connect the skidding and outhaul lines and start pulling in the logs.

After the logs on one spur have been skidded to the track the skidder moves out to another spur and the loader goes in to load out the skidded logs.

On account of the skidder being moved so readily and quickly it can be set so that all the logs are skidded in at practically right angles to the track and therefore skidded the shortest possible distance. This materially reduces the skidding costs.

There are numerious other machines and methods of logging that are adaptable to to pine logging, and for every logging chance there is a particular machine and method that is especially appliable. It is the loggers problem to find and utilize these machines to its best advantage.

Loading.

Several methods of loading have already been mentioned, as the guy line, duplex and swinging boom methods. However as stated before a separate loading unit is particularly desirable in this type of logging.

The Clyde Iron Works, manufactures the McGiffert log loader which has made several notable records and is held in high esteem by a number of loggers. One of its recent records is 429,600 feet of logs in seven hours and thirty-five minutes with one McGiffert loader at the Algoma Lumber Co., Klamath Falls, Oregon.

The machine carries the loading mechanism on a platform supported above the track by means of curved standards or legs, terminating in long shoes which rest upon the ends of the ties outside of the rails when the machine is in operation.

To facilitate moves from one loading place to another it is equipped with swinging wheel-frames and trucks driven from the engine by sprockets and chains.

The construction of this machine is in keeping with the skidders and embodies the essential points of simplicity, strength,stability,and durability.

The frame is designed to support the loading mechanism directly over the track without in anyway interfering with the passage of empty cars through it.

The standards or legs supporting the derrick platform are spaced sufficiently apart to permit free passage of empties, and are curved in at the base to obtain a solid footing on the ends of the ties outside of the rails.

The standards are composed of I-beams bound together with steel plates which are riveted to the outside and inside flanges to support a load up to fifty tons each.A heavy steel foot casting terminates each standard.These flexably engages the center of a long steel shoe which is thus permitted to accomodate itself to the uneven heights of the ties.These shoes have sufficient length to permit them to rest upon several ties at the same time,thus assuring continuously a substantial foundation.

The wheel frames are hinged upon steel shafts secured to the under side of the deck beams.They are made of vertical pedestals of structural steel having a transverse beam to which is secured the drawhead and end castings.

Trucks are equipped with either two or four wheels.The four wheel type is constructed with center plate and bolster so as to swivel in rounding a curve the same as in ordinary trucks on logging cars.They are hung from the wheel frames by a trunnion connection at the ends of the upper bolster.

That empties may have a free passage underneath the machine,the wheel frames are swung from a vertical position to a horizontal position.This allows the machine to settle down on the ties outside of the rails.The wheel frames are enough longer in their relation to the curved supporting standards to force the latter and shoes off the ties and clear the rails.When the trucks are lowered to the rails and the frames are drawn to a vertical position the wheel frame assumes the entire load.The machine is then resting firmly on the trucks and is ready to proceed under its own power along the track to a new location.

The mechanism for raising and lowering the wheel frames consists of a cross shaft upon each end of which a winding drum is placed and keyed.The cross shaft is revolved by means of a worm gear and worm.A clutch connects this gearing with the forward drum shft of the engine.

Four cables,each winding in a separate groove,are secured to each end of the winding drums on the cross shafts.Two of the cables on each drum pass over sheves supported on brackets at the four corners of the frame and thence down to the end castings on the transverse beams of the wheel frames.

The other four cables run under the sheaves on the lower side beams of the frames and thence to their end castings. Thus, when the winding shaft is revolved in one direction, the upper cables are wound on the drum elevatings the swinging frames. while the lower cables are unwound from the drums by the same operation. When the movement is reversed, the upper cables pay out, and the lower cables are wound up, lowering the wheel frames to the track and drawing them to a vertical position.

Motor Trucks in Logging.

Motor trucks are constantly being improved and adapted to logging. At the present time, there are numerous small concerns and some of the larger companies, who are adapting the motor-truck to their special needs.

The following article taken from one of the recent issies of the "Timberman", brings out in a concrete manner one of the many profitable uses of motor trucks.

" Motor Truck Operation Near Atlanta, Georgia.

There were sixteen miles of standard gauge rail-road, with 60-lb. steel and the ties were partially rotted. For locomotive use the entire track would have to be over-hauled. This company found that by using trucks with a wide faced tire and high flange, satisfactory results could be attained. The problem was to find a truck of sufficient pulling capacity with the wide flange that would be adaptable to the rail-road track. They found that they could adjust a two-ton truck to their use because practically all rear driven trucks above two tons have narrow enough treads for rail-road use.

Logging Conditions.

The grade from the mill back into the mountains averaged seven per cent, while on the leads four per cent with one thirty-five per cent curve. These were the conditions under which the work was done. The company had two camps, one ten miles from the mill and the other sixteen miles, with all of the supplies being hauled to these camps by truck. The ten mile hauling job was taken care of by one of the two-ton trucks and 1,500,000 feet of timber came out of this camp at the rate of 12,000 feet per day. The cost of hauling the logs was about forty cents per thousand for gasoline. On this job a record was made, against company rules, by one driver in making the ten miles with a load of logs in thirty-one minutes. Three and a half miles of new track was built, and with one truck logged to a mill of five hundred logs daily capacity. A total of 2,250,000 bd. ft. were logged to this mill in a period of six months, from September to February when the weather was bad.

Four-wheel driven trucks were tried and were found unsatisfactory for this work. While the four-wheel driven trucks because of their four-wheel drive features and heavier motors gave greater traction and pulling advantage, they failed to measure up against the proper stability, while the two-wheel driven trucks showed no effects of the heavy work. The four-wheel driven trucks proved to be defective in the axle bearings, which would crack, they also gave considerable differential trouble. On rails with steel wheels there is considerable slippage, which causes the differential pinion gears to turn over at high speed. The four-wheel driven differential gears would heat and freeze, the shafts or pins on which the gears revolve would work out and fall into the driving gears, thus smashing up the whole differential. The manufacturers of the four-wheel driven trucks claim to have this defect remedied now. There was practically no maintainance on the two ton trucks and very little trouble with them.

Trailers.

In connection with trucks comes the problem of trailers or cars. This company purchased special roller bearing mining car wheels and axles. These wheels had a five and a half inch face and when made up into eight wheeled cars they proved quite satisfactory and did good service. However, by using a light logging car of 2500 bd. ft. capacity, with twenty-four inch wheels, six inch face and two inch flange, they found that as good results or better could be obtained, therefore this type of trailer was adopted.

Some Advantages of Gas over Steam.

Their experience leads them to believe that gasoline, up to certain limits, shows points of superiority over steam. A truck has great power in proportion to its weight. Equipped with wide tires and high flanges, it permits of rapid locomotion and good hauling capacity over track that no locomotive could travel over. It requires no steaming up, as two minutes of cranking will equal two hours of firing for steaming purposes. The fuel question is greatly simplified in that one man with a gasoline pump will handle more heat units andnpower than several men with shovels. Furthermore the fuel weight is practically nothing and the truck will of itself carry a useful load whereas the load carried by an engine consists of heavy coal and water that is solely for its own consumption. Track maintainance becomes of minor importance because eight ties to the rail even for forty-five pound steel will be ample, spikes hold firmly and even the the track may get two or three inches out of gauge the equipment will stay on.

With up-to-the-minute steam equipment of heavy type, these same trucks can be used very profitably, in pulling up steel and ties, laying new track, building bridges and carrying camp supplies.

In the use of equipment of this type, it is needless to say that you cannot carry your loader with you. Loading must be done by a self-propelling machine or a loader set off to one side of the track.

Caterpillar Logging.

Caterpillars used either with high wheeled, trailing in chutes and direct yarding are competing successfully with every other known method of logging.

Logging by steam engines is barred in Government or Indian lands where horses or caterpillars may be used profitably, for silvicultural reasons. This does not work a hardship on the pine logger, however, for the government officials are very reasonable and co-operate freely with the operators so that the stumppage prices are very largely controlled by the accessability with such means of transportation.

The accompanying notes on tractor logging given to me thru the courtesy of the C.L.Best Tractor Company presents the costs and advantages incident to tracter logging. These costs compare faverably with other methods, considering the limitations as brought out in the notes.

SL
Tractors, Gasoline

August 25, 1924

NOTES ON

T R A C T O R L O G G I N G

DAVIES-JOHNSON LUMBER COMPANY, Calpine:

This company did considerable tractor logging last fall, using a Best Sixty with Robinson wheels. The timber ran from 20 to 25M per acre and was located on a side-hill with an average slope of 20%. The maximum slope was 36%. The wheeling distance was from about 500 feet to one-half mile, a level strip 500 to 700 feet wide along the track having already been logged by horse-drawn wheels. There was considerable loose rock on the area and occasional outcrop. All the area was wheeled except a small portion which was very rocky and on which the logs were skidded on the ground by the tractor. The ground conditions were, in the opinion of the camp foreman, about the limit for tractor logging.

The average daily output was reported to be from 35 M to 40 M feet. The total cost on the car, including cutting, swamping, bunching, wheeling, loading, depreciation and woods overhead, was from $4.50 to $5.00 per M. (Foregoing figures given by manager.) In our opinion this is cheaper than the same work could have been done by donkey engines.

At the time of our visit (July 29 and 30) the Best 60 (with Robinson wheels) was wheeling from a gently sloping side-hill where the timber was located across a level flat to the railroad. The distance was about 3500 feet. The tractor could make the round trip in about 22 minutes and was carrying an average load of 2600 feet of 16 foot logs. The bunching was done by a Best 30 and two teams. Part of the labor for bunching and swamping was contracted. Lumberman Dooley secured some output figures which showed that bunching and swamping was progressing at the rate of 45 M feet per day at a labor and supply cost of $1.73 per M. The cutting was contracted at $1.35 per M. The wheeling cost for labor and supplies was 36 cents per M, based on an observed output of 60 M per day. Probably this output is too high for an average. At 45 M per day the cost would be $0.47 per M. The loading cost $0.21 per M. The total cost on the car, as reported by Dooley, was $3.65, which included everything except tractor upkeep and depreciation and woods overhead. We can safely say that the total cost on the car did not exceed $5.00 per M.

Dooley reports the cost of running the tractors as follows, (no upkeep and depreciation included):

Best 60 - Wheeling

Driver, per day	$ 9.25
30 Gal. gas @ 19¢	5.70
Oil and grease	.30
Total, per day	$15.25

Best 30 -Bunching

Driver, per day	$ 8.25
12 gal. gas @ 19¢	2.28
Oil and grease	.30
Total, per day	$10.83

Both the local manager and the woods foreman are very much in favor of tractor logging on ground that is at all suitable and believe it considerably cheaper than donkey logging on the same ground. The manager mentioned several advantages of the tractors over donkeys, such as lessened fire risk, no water system, no wood-cutting, no watchman, and no expensive cables. He said the depreciation on the Best 60 and wheels amounted to 50 or 60 cents a thousand, figuring on a three year life.

The logged over area looked very good in respect to logging damage. The main roads were about 15 feet wide and averaged 150 feet apart. Some additional swamping was done on side roads, but the total damage to reproduction should not exceed 20% on an area basis. By actual count the damage would be much less, since thickets of reproduction were avoided where possible. The small trees left on the area were practically free from injury.

<u>CLOVER VALLEY LUMBER COMPANY</u>, <u>Clover Valley</u>:

The company had just acquired two Holt 10 ton machines which they proposed to use with heavy slip tongue steel wheels. Prior to the delivery of the new tractors the company operated two 45 Holts with somewhat lighter slip tongue steel wheels for hauling and one T 29 Holt and two teams for bunching. The logs were cut 16 feet long and the average load was 2000 feet. The ground surface was generally smooth and the slopes gentle. The average output from July 11th to August 4th was 70 M feet per day, with considerable delay on account of the lack of cars. The wheeling distance rarely exceeded 1000 feet. With the new equipment and an extra bunching team and an ample supply of cars this output could no doubt be increased to at least 100 M feet and probably to 125 M feet per day. The crew necessary for swamping, bunching, wheeling and loading would be about 25 men.

<u>OTEY & McRAE</u>, <u>Clover Valley</u>:

This firm was logging by contract on some steep ground behind a former tractor operation conducted by the Clover Valley Lumber Company. The contract covered the entire logging operation. All the equipment was furnished by the contractors except the loading engine and a water car.

Practically all the ground was steep, the maximum slope being about 45%. A Best 60 and Robinson wheels were used on slopes up to 30%. On the steeper ground the logs were skidded on the ground by a Best 60 and bunched where the wheels could reach them. Two teams assisted in the bunching. The surface was free from rock but very soft and loose. The maximum distance from the landing was about one-half mile.

The wheels were designed for 16 foot logs but on steep roads the logs were cut 32 feet long and the rear ends were allowed to drag in wheeling. Where there were level stretches in the roads the logs were cut 16 feet long. The average load of 16 foot logs was 2000 feet, which was considered too small by the contractors, who said they should average at least 2600. The loads of long logs averaged about 3500 feet. One log scaling nearly 5000 feet was brought in.

The output for July was about 1400 M feet, or 55M feet per day, with some delay on account of the lack of cars. There were about 18 men in the swamping, bunching, wheeling and loading crews. The total number of men in camp, including the cutting crews and operators, was about 35, which gave an average daily output of about 1600 feet per man. The labor and supervision cost probably ran about $4.00 per M. To this should be added depreciation, upkeep supplies, cost of installing camp, etc. We estimate that the total cost (not including interest on investment) was between $6.00 and $7.00, which in our opinion is cheaper than donkey logging under the same conditions.

Mr. McRae said that two Best 60's with Robinson wheels and three Best 30's for bunching should average 100 to 125 M feet per day in fairly steep country, reaching out to one-half mile. In less steep country one Best 30 could be dispensed with. This would put the logs on the car at a labor cost of from $2.50 to $3.50 per M, including cutting. This would be cheaper than donkeys could do the work reaching out the same distance.

LASSEN LUMBER & BOX COMPANY, Wingfield Operation:

One Best 60 was skidding to motor trucks. The average maximum distance was 800 or 900 feet. With three men in the crew the output ran from 40 to 45 M per day. The cost of labor and supplies was about 70 cents per M. The loading and trucking were handled by contract. The contractors used a Best 60 and a gin pole for loading.

The slopes were variable, running up to 45%. The soil was loose decomposed granite with considerable loose rock and occasional outcrop.

The output for July was slightly over 1000 M and the average labor cost of cutting, skidding, and supervision was $2.91 per M. The output was lowered somewhat on account of the trucks being unable to keep up with the skidding.

Both the camp foreman and the manager were enthusiastic about tractor logging. They believed, however, that the Wingfield area was about the limit for tractor skidding and that some of it was too steep for wheeling.

LASSEN LUMBER & BOX COMPANY, Bunnell:

A Best 60 was skidding to motor trucks. The work was contracted at $1.50 per M, the contractor furnishing the equipment. The slopes averaged 25 or 30%, with a maximum of 45%. Some skidding was done uphill on a 15% slope.

The soil was fairly rocky over most of the area and extremely so in a few places.

The crew consisted of the tractor driver, one swamper and hooker, and one teamster. The teamster drove a two horse team and bunched the small logs prior to skidding. From output data kept by Scaler Sweetland he estimated that the tractor should average 35 M feet per day going out to a maximum distance of 1,000 feet. By using trucks equipped with trailers the logs could be skidded in 32 foot lengths and the output could be materially increased.

This area would be considered harder than average donkey ground. The cost of tractor logging was undoubtedly less than it could have been logged by donkeys.

RED RIVER LUMBER COMPANY, Chester Operation:

The tractors were not operating at the time of our visit. We talked to one of the officials of the company and learned that the costs had been very satisfactory. We believed that the tractors would displace not only donkeys, but also horse drawn wheels.

The area logged was level or gently sloping and carried a heavy stand of timber.

CONCLUSIONS:

The operators interviewed were unanimously in favor of tractor logging for suitable country. The main advantages mentioned were:

(1) Low operating cost per M feet.

(2) Mobility of equipment. This is a particular asset in logging light or scattered stands.

(3) Lessened fire risk.

(4) Less damage to reproduction and young trees left on the ground.

(5) Saving in railroad construction often possible.

Conclusions drawn from the opinion of operators and upheld by our observations are:

(1) Bunching costs are high in comparison with similar costs for horse drawn wheels on account of the larger loads required for tractor propelled wheels and also on account of the steeper country in which such equipment is often used. The use of tractors for this work will reduce the cost materially. A machine is now being perfected that will carry a

drum attachment capable of handling 500 feet of cable. This should prove of great value in bunching and also in yarding logs from parts of the area that are too rough or steep for the tractors. Several operators are considering the feasibility of a bunching machine operating on the principle of a swing boom loader.

(2) When bunched, the logs can be wheeled at a very low cost.

(3) Skidding on the ground is often the most practicable method of using the tractors, particularly on the steeper slopes. For ground of varying slope where the logs must be transported a considerable distance (over 1,000 feet) to the railroad car or truck, a combination of skidding and wheeling should prove the most advantageous method.

(4) Wheeling can be practiced on slopes up to 6% against the loads and 30% with the loads. The tractors can be handled so as to skid on slopes up to 45%. A uniformly rocky surface will cut down the range of the machines below these figures, and will also shorten the life of the equipment. Where only part of the surface is rocky and the machines have an opportunity to travel most of the time on good soil, the above maximum figures should hold.

(5) The maximum wheeling and skidding distances depend on the density of the stand and the lay of the country. Probably 1,000 feet for skidding and from 2,000 feet to one-half mile for wheeling are fair averages. Economical wheeling, however, has been done over distances up to one mile.

(6) Depreciation is a large item, but should be more than offset by savings in operating costs. Most operators figure on a life of three years for tractors and wheels.

We believe that hearly all the east slope timber can be logged economically by means of tractors. There will be some exceptions where it is impracticable to place the railroad beneath the timber, or where the slopes are too rough or steep, but such areas are relatively small. The necessary mileage of railroad construction will be lessened rather than increased by the use of such equipment. Fr west slope timber the use of tractors will be controlled (1) by the roughness and steepness of the slopes and (2) by the limitations on railroad layout. It is believed that few large operators can dispense entirely with donkey logging, but that a considerable part of their logging can be just as well, if not better, handled by tractors. A combination of the two types of equipment should prove very advantageous in this region.

Respectfully submitted:

J. H. Price
Logging Engineer

J. R. Berry
Chief Lumberman

Logging Costs.
Fruit Growers Supply Co.
Susanville, California.

March I924.

	Cost per-M	Scale.
Donkey #4.	3.78	I54,050
" "7.	2.88	287,I20
Jammer "I.	2.I0	42,240
" "2.	----	---,---
Ohio Crane 50 ft. Boom.	I.42	I80,070

Total Scale---------663,480
Average Cost per-M 3.7I

Falling	2.92
Bucking	2.I6
Limbing	.80
Donkeys	2.36
Wheeling	.97
Transport.	I.86

Cost for all camps March. $20.45.

April I924 DonkeyS

	Cost per-M.	Scale.	Days Worked.
#.4.	2.53	I,050,200	25
#.5.	2.65	600,750	I6
#.6.	2.62	952,200	27
#.7.	2.45	I,062,460	27

Jammers #.I. (Wheeling, yarding, and loading)

Wheeling Cost.	I.02	Wheeling--------	9
yarding & Ld.	I.06	Yd. and Load.-	I8

Jammer #.2.

"	I.II	"	7
"	I.76	"	I9

Jammer #.I. Wheel Scale--- I,053,960
Load & Yd."--- 776,560

Jammer #.2. " --- 932,430
" --- 685,580

Average Cost per-M. $3.09
Total Scale-------- 7,527,400
Cost per all Camps $8.0I

Falling----------0.82
Bucking----------0.92
Limbing----------0.38
Donkey Logging--I.30
Wheel " --I.69
Transportation--0.67

Logs on ground at each landing December I,I924.

Camp "C"

Spur #.I0.	Donkey #.4.	Landing #.1.	
" " I0	" #.4.	".I.	325,230
" " I3	" #.6.	".2.	546,620
" " I3	" #.6.	".I.	425,2I0
" " I3	Jammer#.2.Decking.	".2.	2I0,I00
" " I3	LOgs left by Packalog.		532,400
			78,000

Camp "F"

Spur #.I8.	Landing #.9.	I50,000

Camp "D"

Spur #.I6B	Donkey #.5.	Landing #.6.	428,900
" " "	" " 5"	" ".7.	548,780
" " "	" ".7.	" ".8.	594,480
" " "	" ".3.	" ".3.	II2,I20
" " "	" ".3.	" ".4.	780,620
"	"	"	
			4,732,460 M On ground.

Camp "B".
92,800 B.M.

This includes contract logs on top of Antelope Butte.

Part of the equipment of this outfit consistsof the following;

McGiffert I/4 swing boom jammers.
Manufacturers --Clyde Iron Works.
Boom Donkey (yarding distance averages I000 ft.)

Donkey #.4.	IIxI3	St.gear	Willamette
" #.5.	" " "	"	"
" #.6.	"	"	"
" #.7.	IIxI4	"	Washington.
" #.3.	I2xI4	Two speed	Willamette.

The I2xI4 yarding distance averages I700 ft.

Transportation costs include;
- Maintenance
- Labor
- Fuel
- Material and Locomotive repair
- Includes some car whacking.

Finis Etc.

Falling Monthly cost per-M		Bucking Monthly cost per-M	Limbing Monthly cost per-M
March	2.92	2.I6	0.80
April	0.83	0.92	0.38
May	0.49	0.58	0.23
June	0.53	0.6I	0.25
July	0.37	0.48	0.I6
August	0.43	0.48	0.2I
Sept.	0.58	0.69	0.28
October	0.60	0.7I	0.29

Falling, Bucking and Limbing Costs for all Camps I924.

Total costs	Felling	$37,605.7I
" "	Bucking	43,059.50
" "	Limbing	I7,I65.76
		97,830.97---Total .

Total Scale year I924, felled, bucked and limbed. 67,422,920/M

Scale BY Months-With Costs Per-M

	/663/480	663,480	3.7I
March	xxxxxxxxxxxx	7,527,400	3.09
April		I3,978,I40	2.30
May		9,I92,490	2.74
June		8,463,930	2.45
July		9,753,290	2.36
August		I0,693,860	2.60
September		6,923,990	3.08
October		2I6,340	3.94
November.	Total---	67,422,920	

	McGiffert (Jammer #.I.)		McGiffert (Jammer #.2.)
Seasons costs per-thousand b.m.			
April	I.03	------------------	I.I2
May	0.86	------------------	0.86
June	0.96	------------------	0.93
July	0.97	------------------	0.95
August	0.97	------------------	0.96
Sept.	0.95	------------------	0.99
October.	0.99	------------------	I.04
	6.73	Season	6.87
	0.97	----Averages------	0.96

Donkeys

Seasons Cost per-thousand board feet.

	#.3.	#.4.	#.5.	#.6.	#.7.
April	4.68	3.78	2.74	2.73	2.88
May	4.59	2.69	3.00	2.58	2.54
June	4.6I	2.66	3,24	2.75	2.76
July	4.22	2.80	3.25	2.76	3.24
August	4.33	2.87	2.93	2.86	3.I2
Sept		2.99	3.06	2.95	3.I4
October			3.4I	3.07	3.26
November					3.27

October I924.

Donkeys	Cost per-M	Days worked	Scale.
#.3.	4.70	I3	366,780
#.4.	3.9I	8	289,420
#.5.	4.88	20	423,390
#.6.	3.70	23	635,220
#.7.	4.96	8	209,330
Jammer #.I.	I.20	27	3,7I4,340
Bunching	0.38		
Swamping	0.76		
Jammer #.2.	2.38	I4	954,630
Bunching	0.82		
Swamping	0.76		
Ydg.& Ldg.	2.08	9	I88,650
Ohio Crane	I.38	6	I42,230
	3.08		6,923,990
Falling	0.60		
Bucking	0.7I		
Limbing	0.29		

Transportation

Cost for all Camps $7.84

Above figures include repairs and renewels account of fire.Advance logging expenses.Donkey fuil.Extra donkey runners.Ramsey contract.

November I924.

Donkeys	Cost per-M	Days worked	Scale
#.3.	3.69	6	I3I,I30
#.6.	9.8I	I	I7,400
#.			

Jammer #.I. Shut down.

Jammer #.2.			
Yarding and loading	2.69		28,790
Ohio Crane.	I.88	3	39,020
	3.94		2I6,340
Falling	0.37		
Bucking	0.37		
Limbing	0.I7		

Cost for all camps $0.75

CAMP CLOSED NOVEMBER 25,I924.

Above figures include Extra donkey runners and advance logging costs as fuil for season of I925.

<u>Note</u>:

Cost for all camps includes;

Cookhouse
Misc'l Camp Expenses
General Woods "
Advance logging costs.
Railroad spur construction.
Mainline R.R.construction.
Picking up spurs.
Transportation

July I924 (continued)

	Cost per-M	Days Worked	Scale.
Ohio Crane	I.I3	I3	343,2I0
	2.47		8,463,930

Average cost for month and Scale for month.

Falling	0.37
Bucking	0.48
Limbing.	0.I6
Transportation.	

Cost for all Camps July I924. $7.I6

August I924.

Donkey	Cost per-M	Days Worked	Scale.
#.5.	2.3I	I3	606,I90
#.6.	3.58	I0	304,520
#.7.	3.68	3	7I,620
Jammer #.I.	0.93	24	4053,820
Bunching	0.48		
Swamping	0.93		
Jammer #.2.	I.0I	23	4,I37,390
Bunching	0.50		
Swamping	0.97		
Ohio Crane	0.97	2I	579,750
	2.36		9,753,290

Average Cost for August and total scale for the month.

Falling	0.43
Bucking	0.48
Limbing	0.2I
Transportation.	0.46

Cost for all Camps $6.27

September. I924.

Donkeys	Cost per-M	Days worked	Scale.
#.3.	3.50	I2	434,I90
#.6.	3.25	26	785,590
#.7.	3.72	2I	6I7,020
Jammer #.I.	0.89	26	4,887,430
Bunching	0.56		
Swamping	I.04		
Jammer #.2.	I.I3	25	3,763,500
Bunching	0.56		
Swamping	I.04		
	2.60		I0,693,860

Average Cost for Sept. and total scale for month.

Falling	0.58
Bucking	0.69
Limbing.	0.28
Transportation	0.48

Cost for all camps $6.29

Above figures include repairs and renewls a/c of fire.
Extra donkey runners and Ramsey contract.

May. 1924.

Donkeys	Cost per-M.	Days Worked	Scale.
#.4.	2.62	23	964,830
#.5.	3.27	15	560,240
#.6.	2.46	26	1,110,720
#.7.	3.58	10	416,490
#.3.	4.06	15	650,770
Jammer			
#.I.	0.82	27	5,085,860
#.2.	0.82	28	5,189,230

Average Cost for the month---$2.30
Total Scale " " " ---13,978,140
Cost for all Camps --- $5.44

Falling---------0.49
Bucking---------0.58
Limbing---------0.23
Donkey Logging-
Wheel " -
Transportation-0.57

June 1924.

Donkeys	Cost per-M	Days Worked.	Scale.
#.3.	4.17	3	135,690
#.4.	9.35	2	45,780
#.6.	5.30	3	138,40

Camp shut down June 4th account of wreck with engine #.4.

Jammer #.I.	1.09	25	4,413,730
Bunching	.57		
Swamping	.85		
Jammer #.2.	1.03	25	4,459,240
Bunching	.47		
Swamping	--.95		
	2.74		9,192,490

Average Costs for the month and total scale.

July 1924.

Donkeys	Cost per-M	Days worked.	Scale.
#.4.	4.47	4	101,480
#.7.	2.73	15	553,070
Jammer			
#.I.			
Wheeling and loading	1.08	21	3,616,680
Bunching	0.54		
Swamping	0.94		
Jammer #.2.			
Wheel & Ld.	0.97	21	3,849,490
Bunching	0.47		
Swamping	0.85		

C. L. BEST TRACTOR CO.

BEST
TRACKLAYER
TRACTORS

CABLE ADDRESS
"BESTRACTOR"
SAN LEANDRO, U.S.A.

SAN LEANDRO, CALIFORNIA

January 26, 1925

Mr. Trevor Lewis,
2855 Jackson St.,
Corvallis, Ore.

Dear Mr. Lewis:

This will acknowledge receipt of your letter of Jan. 18th, and we are pleased to send you, under separate cover, our catalog and other literature illustrative of the uses of Best Tractors in the woods.

We are pleased to enclose herewith a report recently received from the U.S. Forest Service, compiled by a Logging Engineer, Mr. J.H. Price, which we believe contains some valuable data for use in your paper.

We will be pleased to have you look through the printed matter and mark any illustrations therein that you would like to use in your paper and send these to us, so that we may make cuts of whatever size you need to illustrate your work.

Should there be any further information you might desire we shall be glad to supply same to you upon receipt of your request.

Yours very truly,

C. L. BEST TRACTOR CO.

[redacted]

Sales Representative

R. E. Anderson
AMB

As to which is the most practical, horses or caterpillars affords a topic of endless debate among pine loggers. As an example two of the large pine operators, working adjacent timber tracts, one the Shevlin-Hixon Co and the other Brooks, Scanlin Co. disagree as to which is the better. Brooks, Scanlin are still using horses, Lidgerwoods and Clyde or McGiffert Leaders and are very much predjudiced against caterpillars, while the Shevlin Hixon Co. has completely changed over from horses to Best 60 Tractors, Lidgerwoods and McGiffert leaders and are very well pleased with the change, both as to costs and to performance. It is also interesting to note that the latter Company has practically discarded the Clyde Skidders and are using Lidgerwood S Steel Spar Skidders, Best Caterpillars with Best and Robinson Wheelers The loading for the caterpillars is all done by the McGiffert Leader. The only objection to the Clyde Skidders seemed to be that whereever they were used there was a tendency to kink the rails or damage the road-bed. In the latter case it is well to remember that the ground is of a volcanic ash or sand and this same material is used for ballast, therefore has not the natural foundation for heavy machinery. It is not deemed practical to ballast or add ties for such close intervals as the Clyde Skidders require.

The Shevlin-Hixon Co. also uses a crane for yarding and loading logs short distances and moving camp. The cook-houses and bunk cars are mounted on trucks, while the family houses, commissary and engineers office are constructed to withstand the stress incident to being loaded and unloaded by this crane onto flat cars. The crane has extra equipment which may be used in making a pile driver out of it or by guying the boom yarding for a considerable distance may be accomplished. In other words, the crane is the general utility machine and is practically indespensible in a large logging concern of this kind.

Bibliography.

C.L.Best Tractor Co.   San Leandro , Cal.
The Holt Manafacturing Co.   Seattle, Wash.
Lidgerwood Manufacturing Co.   Seattle, Wash.
Clyde Iron Works Sales Co.   Portland, Oregon.
Willamette Iron and Steel Works.   Portland, Oregon.
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