A PORTABLE HEEL BOOM LOADER

by

Harley E. Horn

A Thesis
Presented to the Faculty
of the
School of Forestry
Oregon State College

In Partial Fulfillment
of the Requirements for the Degree
Bachelor of Science
June 1948

Approved:

[Signature]
Professor of Forest Engineering
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>WINCH DESCRIPTION</td>
<td>3</td>
</tr>
<tr>
<td>TRUCK DESCRIPTION</td>
<td>3</td>
</tr>
<tr>
<td>BOOM DESCRIPTION</td>
<td>4</td>
</tr>
<tr>
<td>TURNTABLE DESCRIPTION</td>
<td>5</td>
</tr>
<tr>
<td>STABALIZER</td>
<td>6</td>
</tr>
<tr>
<td>COST</td>
<td>6</td>
</tr>
<tr>
<td>VARIATIONS</td>
<td>9</td>
</tr>
<tr>
<td>CONCLUSION</td>
<td>11</td>
</tr>
</tbody>
</table>
A PORTABLE HEEL BOOM LOADER

INTRODUCTION

Logging operations in the Douglas Fir region have normally been associated with big timber and big equipment. Douglas Fir is by nature a large tree and often grown in rather rough country. In order to get this timber out it is necessary to use large yarders or large tractors. When the logger starts thinking along these big equipment lines, he keeps right on thinking along these lines. He carries his thoughts with him into loaders, trucks, saws, and almost everything he uses and does.

There are, however, some operators who are no longer logging big fir. Some of them are operating in the smaller timber east of the Cascades, and some of them are logging in second growth.

Even though these operators aren't in big timber any more, they can't get rid of the big equipment idea. There is a rather basic fact that most of them prefer to overlook. It is that they are working in timber in which they have only a few really large logs, and the remainder are of medium or small size. Rather than equip for these medium and small logs and use some other means to handle the few large logs they will have, most of these operators equip for the largest they expect.
This paper will deal only with one phase of this idea; loaders. It is more or less agreed by most loggers that a portable loader is an excellent piece of equipment, however, the big equipment idea still holds. Therefore, the only portable loaders considered have been large shovels.

Shovels have a high initial cost, and as a result they must be used almost to capacity at all times to keep the per thousand cost of them down to a reasonable figure. Cost is not the only thing that defeats the idea of a shovel. There is again the size. A shovel is a rather large piece of equipment and if it must be moved from one show to another over public roads, special equipment must be used. The logger may have to hire a low-boy or even disassemble the shovel. Either procedure is a costly one.

The smaller operators largely agree that they would like to have a portable loader that would do the job and whose initial cost is not out of reach of their limited resources. I think the answer to this situation is to be found, for a great many operators, in the machine to be described here.
A PORTABLE HEEL BOOM LOADER

The loader herein considered is one which is actually being constructed for use in Douglas Fir timber, containing up to 2000 feet per log, east of the Cascades. The loader consists of a two-drum winch mounted on a solid tired truck and rigged with a heel boom.

WINCH DESCRIPTION:

The winch being used on this machine was built by the Alaska Junk Company. It is a two-drum friction drive winch. It is powered by a 48 HP Hercules gas engine working through a 3 speed automotive transmission. Alaska Junk has discontinued production of this winch, but for a similar set-up any two-drum winch will do. Of course the size must be kept down so that it can be mounted on a truck. It would be possible to rig this machine using a single drum winch and the turn-table as will be described later.

TRUCK DESCRIPTION:

The truck used for this machine is a 1925 White. It is a single axle, solid tired truck. The wheelbase is 13 feet. The frame is constructed of I beams 3 5/8 inches x 7 inches and extends 5 feet behind the rear axle. It is 3 feet 9 inches wide from center to center.

It was decided that a single axle rig would be big enough and the initial cost on it is less. A solid tired
Above; A view showing the relative location of the drums.

Below; A view of a log heeled against the boom.
rig was chosen because it eliminated any tire upkeep. With a solid tired rig it is possible to pick up and move without having to inflate any tires. Also, the machine can be left sitting in one place for a period of time without the tires deteriorating. However, if a pneumatic tired truck is on hand, it would probably be cheaper to use it than to purchase another just because it had solid tires. The same would hold for a dual axle truck that may be on hand.

BOOM DESCRIPTION:

The boom and A frame were constructed of Douglas Fir 14 inches in diameter. The A frame is 22 feet long and the boom is 35 feet long. The A frame is mounted on the truck frame 18 inches in front of the rear axle. The boom is fastened to a turntable the center of which is 48 inches to the rear of the A frame.

Both the boom and A frame are mounted in sockets as shown in Figure 1. Sockets constructed in this manner were used so that the boom and A frame can be lowered to a trailer for moving. They will speed the rigging up of the machine when it is moved from one location to another.

The sockets are fastened to the pivots at an angle so that the members will come together in 40 feet with the bases 48 inches apart.

Since the boom and A frame are mounted on pivots, they both may be lowered for moving with a minimum of work.
FIGURE 1

Center Line of Socket

Center Line of Base

1" x 4" Plate

1 1/2" Pin

Base
View of the under side of the boom showing construction.
It is necessary to loosen only the sail guy and the boom can be lowered. The A frame can then be lowered by loosening the guy lines and the machine is ready to move. To set up, the process is reversed. The guy lines holding the A frame are tightened and the boom is raised; then the sail guy is fastened. This job of raising and lowering the boom can be speeded up somewhat by using the haul-back drum to tighten and loosen the sail guy as shown in Figure 2. This will also enable the boom to be raised or lowered while the machine is in operation, if desired. This can be done, of course, only if the haul-back drum is equipped with a dog.

TURNTABLE DESCRIPTION:

The methods which can be used to swing the boom are innumerable. This particular loader was designed with the idea of getting a maximum swing of 180°. To do this, some method must be used other than a squirrel and line. It was desirable to use some mechanical means so that the machine would be as self-contained as possible and thus keep the rigging time and work at a minimum. To meet the above requirements, the following method was used:

A sprocket was attached to the main line drum. This works through a chain and drives an automotive transmission and clutch. This in turn is coupled to a war surplus truck winch. From this winch two lines are run to a large drum
View of the turntable showing the turntable drum and the boom sockets.
attached to the turntable. When the winch is run forward
the boom swings in one direction, and when the winch is
reversed the boom swings in the other direction.

The automotive clutch and transmission were used to
reverse the winch and to have a positive control over it.
In this way, by slipping the clutch, it is possible to
move the boom any amount desired.

The war surplus truck winch was used because it has
a worm drive and therefore will stop and hold whenever the
power is cut off from it. In this way we have a very pos-
itive control over the boom at all times.

STABALIZER:

This machine will have a tendency to tip when logs
are being picked up at the extreme side position. To over-
come this tendency, some sort of stabilizer must be used.
The method to be used here is to fasten a large timber
to the under side of the frame. This timber will be 9
feet overall and will be supported on each end by screw
type house-jacks. Instead of a timber it would be more
convenient to have an 8 inch I beam sliding in a channel
iron housing as shown in Figure 3. This arrangement would
not be quite so cumbersome but would cost a little more.

COST:

As was mentioned before, the most important part of
A close-up of the swing-drum.
END VIEW
Scale 3" - 1'

SIDE VIEW
Scale 1\frac{1}{2}" - 1'

FIGURE 3
any machine, to most small operators, is the matter of cost. The cost of a machine of this type is very reasonable.

The double-drum winch used here cost $1750.00 complete with power plant. The truck was bought from a dealer at a cost of $250.00. The boom and A frame were constructed by the crew at an approximate cost of $300.00. The turn-table and boom sockets were made in a local machine shop at a cost of about $200.00. The total assembly of parts took about a week and cost about $300.00. Adding to this an estimated cost of $200.00 for lines and rigging we have a total cost of $3000.00. While some of these costs are only estimates, they are sufficient to cover all the costs involved. They may be lowered some if the work can all be done in a company shop.

To give a general idea as to how much it will cost to load with this machine, the cost data has been worked out as follows:

The total investment is taken as $3000
Life of the machine is assumed to be 3 years of 200 8 hour days.
Depreciation is $3000/3 or $1000 per year
Average Annual Investment is $3000 + $1000 or $2000
Fixed Charges:
1. Interest 5%
2. Taxes 2 1/2%
3. Insurance 3%
4. Miscellaneous 1 1/2%

Total 12% of the Average Annual Investment or $1.20 per day

Depreciation: $1000 per year or 5.00 per day

Operating Charges (Estimated)
1. Repair parts and replacements 0.50 per day
2. Supplies 3.00 per day
3. Labor
   1 head loader $16.00
   1 second loader 14.40
   1 engineer 15.80
   46.20
   plus 20% 9.24
   55.44 per day

Total $65.14 per day

Assuming production at 40M per day the cost per thousand is 1.63

Of this labor accounts for 1.39 per M

Loader cost then is 0.24 per M

This cost of $.24 assumes that the loader will last for only 3 years and that it will be used to load only 40
thousand per day. The figure 40 thousand was used because it is felt that it is an amount which can easily be handled by this machine over a period of time.

If the life is longer than 3 years or if more or less than the 40 thousand is loaded per day, the only fluctuation will be in the cost of the loader per thousand or a fluctuation in the 24 cents.

VARIATIONS:

As was mentioned before, the possible variations on this machine are about as numerous as the number of men who would build them. Everyone will have some different way of doing one or two things.

As a comparison the writer will take up one or two possibilities that have come up in construction. The winch and truck used will depend on what is on hand or readily available. These are all more or less standard and the only work is to set the winch on the truck and fasten it down. The many variations come in the method of turning the boom.

It may be desired to swing the boom by the conventional manner of two lines or a line and a squirrel in which case the portability becomes the major saving.

In the case of the self-contained turning mechanism, which I think is one of the biggest savings in time and utility, there are many possibilities. One method
considered was to have the turntable connected to a gear and pinion. The pinion would be driven by the automotive transmission. One of the drawbacks of this method is that the momentum of the boom would carry it on after the power was cut off. A second drawback is that after the turntable becomes worn it may tip enough to throw the gears out of mesh. Both of these things could be overcome very easily is this method of turning is preferred.

Another solution which may be more satisfactory if all the machines incorporated here are to be purchased new, would be to use a 3 drum loader. These machines have 2 swing drums which could be connected to the drum on the turntable. This would also give positive control over the boom since both drums are equipped with brakes and frictions. One of the drawbacks is that these drums may be too fast since they are designed to be fastened to the end of the boom through blocks. On the cost side, these machines are a little more expensive than a one or two drum machine.

Still another solution is to employ an oil-gear motor instead of the automotive clutch and transmission. This would give very good control over the speed and power on the boom in both directions. The only drawback to this arrangement is the cost. One of these motors would cost $1100.
From the few variations shown above it can be seen that, depending on what is used for truck, winch, and turntable, the cost of this machine can vary from $3000 (as in the one described) to $5000 or $6000.

CONCLUSION:

At the time of this writing, this loader has been used to load 5 or 6 loads. The logs from this show are small, few of them contain more than 1000 feet, but they were all handled easily, and gave a good idea of the possibilities of the machine.

It was discovered that the boom can be swung out to about 45° without any outrigger. It was also discovered that the machine should be set as near level as possible fore and aft. It will help if the machine can be tipped a little, probably 1 or 2 inches, in the direction logs are to be swung. This will make the boom swing over the load more easily.

Since the boom swings rather slowly, it is better if the logs to be loaded are kept within 15 feet of the truck. Logs can be reached as far as 25 feet away without pulling the line much and even farther if the second loader carries the tongs out. I would not recommend a distance of more than 15 feet except in rare cases.

In the limited time the machine was used, it has become apparent that it would be entirely feasible to load
Above: Side view of the loader showing the relative location of the parts.

Below: View of the machine setting at the landing.
Above; Reaching for a log.

Below; The log in the air.
60M feet per day from a hot landing. These conclusions are all based on a 3 man crew.

This machine does not replace either the sled mounted loader or the shovel but represents an in-between machine for those operations where neither of the others quite meet the requirements of cost and portability.

It should be understood that modifications will be needed to meet the requirements of the various places the machine will be used, but the basic principle is sound and the size is adequate for this show. The principle will work on any show and the size can be changed easily to meet varying conditions.

I would highly recommend a loader of this kind to anyone who is logging in this type of second growth and small old growth timber and who is not putting out more than 50 or 60M per day. By this size of timber I refer to timber averaging under 1000 feet and having only a small percentage running over that. These bigger logs can be loaded one end at a time, but this method takes longer.